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Coaches' acquisition of sport science knowledge and the role of education providers

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Abstract

The aims of this thesis were to better understand how coaches perceived and accessed sport science knowledge and to determine the role of National Governing Bodies (NGBs) and further and higher education (FHE) in facilitating coach training and education in sport science. Additionally, studies sought to identify any barriers to more effective access and implementation to such knowledge within this population. Firstly, adopting a loosely structured interview approach, eight expert sport coaches were interviewed about their perceptions of sport science knowledge and practice. Thematic analysis of the interviews revealed three first-order themes; *knowledge acquisition* (KA), *knowledge translation* (KT), and *qualities of practitioners and coaches* (QPC). *Formal* methods of KA included *Higher Education* and *National Governing Body (NGB) training*, whilst *blind faith* and *mentoring* were both revealed to be sources of *informal* KA. *Conceding advantage* and *complexity of language* (de-jargonising) were both revealed to be barriers to KT, whilst the use of *virtual learning environments* and *traditional workshops* were both favoured as means to disseminate and translate knowledge. *Opportunity*, *research lag and accessibility*, and *casual employment* were all identified as barriers to successful KT. The most valued QPC in practitioners were *expertise*, *knowledge of the sport*, *building rapport* and *humility*, whilst an *open mindset* and *clarity of performance objectives* were identified for coaches. Much of the findings from the first study corroborate previous research examining coach training and education and the salient characteristics of sport science practitioners that support successful translation of knowledge into sport coaching practice. In addition, these expert coaches displayed features of adaptive expertise in their decision-making and approaches to sourcing new knowledge. To understand these results in the professional domain, a larger sample of sport coaches was surveyed on the location of sport science topics and disciplines in coach training and education, actual and preferred sources of knowledge, and the role and function of FHE, NGBs and Continued Professional Development (CPD) in coach development. A mixture of mostly non-formal, online methods were identified as popular actual sources of sport science knowledge, whilst informal methods were the most popular preferred source. This may be in part owing to COVID-19 restrictions, but also substantiates previous research investigating learning in sport coaching. Sport psychology and skill acquisition were rated the most important sport science disciplines, with a number of statistical differences observed between routine (Level 1 and 2) and adaptive (Level 3 and 4) experts in the level of importance placed on key sport science topics. No differences were observed between expertise level and location of these topics in the coaching curriculum. A number of recommendations are made in accordance with recent policy initiatives to re-evaluate and professionalise sport coaching in the UK.

Candidate Declaration

I hereby declare that:

I have not been enrolled for another award of the University, or other academic or professional organisation, whilst undertaking my research degree.

None of the material contained in the thesis has been used in any other submission for an academic award.

I am aware of and understand the University's policy on plagiarism and certify that this thesis is my own work. The use of all published or other sources of material consulted have been properly and fully acknowledged.

The work undertaken towards the thesis has been conducted in accordance with the SHU Principles of Integrity in Research and the SHU Research Ethics Policy.

The word count of the thesis is **60957** words.

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Acknowledgements

Once upon a time in a galaxy (not so) far far away (a homage to the significance of *Star Wars* in my life), there lived a Foolish Boy who believed that he was invincible and could get through life relying on his natural, superhuman abilities (OK, so he wasn't superhuman, but it makes the story sound better!). Unfortunately, the evil Lord A-Level's decreed that the Foolish Boy was going to be unable to use his special skills to get into the magic kingdom of Degreedom. The evil Lord A-Level's put Rugby Union, Field Hockey, beer and girls in front of the Foolish Boy, who was tempted by them all and failed to get into the magic kingdom. The Foolish Boy decided to drown his sorrows with his friends, Jack (Daniels) and John (Smiths), and thought the world, as he knew it, had ended. The following day, the Foolish Boy was struck down by a mysterious illness (three guesses what it was, but they probably aren't needed!) and was unable to eat, drink or even move. Although this illness had made the Foolish Boy very weak, and unable to use his exceptional powers, the Foolish Boy's parents went to him by his bedside and said, 'Do what you have to do, and we will support you in any way we can' (or at least words to that effect). This was a very special moment, and it returned some strength to the Foolish Boy.

Although his special, superhuman powers failed to return to the Foolish Boy, he could use this strength, buoyed by the support that he received from his parents, to get a place in an area of Degreedom called the 'Crewe and Alsager Faculty', which he had never heard of before. For four long, and sometimes arduous, years, the Foolish Boy realised that the unfortunate circumstances with which he ended up at the Crewe and Alsager Faculty were fate; he came to realise that the evil Lord A-Level's had, in

fact, done the Foolish Boy an enormous favour. His place in Degreedom was assured by his acceptance as a graduate, a special recognition in Degreedom reserved for only the very best entrants. At the ceremony to award his graduate recognition were his parents, the two people who trusted the Foolish Boy when he needed it most and allowed him to fulfil his dreams. On his journey after Degreedom, the Foolish Boy made many mistakes, and broke many hearts (including his own), on his way through the working world. After many years of such mistakes the Foolish Boy was lucky enough to meet the love of his life, who gave him both the courage to continue his journey beyond Degreedom (towards a higher honour only bestowed on those who completed hours of extra study called a Doctorate of Professional Studies) but also a funny, clever, beautiful and independent young family of his own. The End.

Without question, the love, support and constant questioning (more specifically, 'When are you going to get that damned thing finished?') from my parents Michael and Yvonne and my wife Jane, and the love and affection that I receive every day from my children Jacob and Imogen has got me to this point. I have been on some dark paths in my life and have stuck with this programme through some challenging personal and professional times because of the belief that they have shown in me. My parents have taught me the meaning of hard work and perseverance, and I will always be grateful for that. My Wife has the biggest heart of anyone that I have ever met and is the reason why my children are beautiful both inside and out. If I was competitive, I'd be saying that I have the best Wife in the World ('Don't be ridiculous, you haven't met every Wife in the World). She is the solvent that keeps our family together when I am galivanting around the World and working through the night and

at weekends. There would be no family without her, and I would have no family without her. I don't know what difference completing this programme of study will have on my life, but I know that any future success that I have personally and professionally will be down to all of them. I hope that my irritable and distant rants down the telephone, late nights ('I'm leaving the office in five minutes, I promise'), impatience and generally miserable outlook on life will be lifted long enough for me to show them. I have no idea what I can do to repay the faith that they have all shown in me, but I will do my best. I promise.

I would also like to take this opportunity to acknowledge the support I've received from two 'Grandfathers' of Sport and Exercise Science. I would not be where I am without the honesty and clarity that Les Burwitz and the late Edward Winter provided me over the last twenty-five years working in Higher Education. Les was my Head of Department when I first ventured into lecturing at Manchester Metropolitan University (Cheshire) and is one of the most humble and self-depreciating people that I have ever had the pleasure to call a colleague. I wish that I could be more like him. Latterly, as I braved a new venture at Sheffield Hallam University, Edward's good humour, epic tales and consistent high standards were a constant reminder of what I should be striving to achieve. He is sorely missed.

I would have not got this far if it were not for the patience, understanding and tenacity of a number of people along the way. In particular, my thanks go to Professor Frances Gordon and Doctor Alison Purvis for seeing me through to the end as members of my supervisory team at different times. Frances made the incredibly difficult decision to retire before I finished, and I know it must have been heart-

wrenching to leave me! Seriously though, I do not know what I would have done (at a particularly difficult time) without Frances giving up her time to help me in the formative stages of the research phase of this project. I was a metaphorical hobo, in terms of a supervisory team, before she came along. Alison has been my Director of Studies for the past two years, but our relationship goes back much further than that. As a trusted colleague, a guest at my wedding (whose resplendent photography put our official photographers to shame), and more recently my line manager, Alison is 'one of the good uns'. Thanks to all of you.

Finally, my participants. Many of our greatest sporting successes are either directly or indirectly down to their perseverance, graft and resilience without the acknowledgement that it truly deserves. Thank you for giving up your time and being unreservedly candid in sharing your time, experience, thoughts and ideas.

Background to the Research

Context

Levels of sporting success in Great Britain and Northern Ireland is at an unprecedented level. Fourth and second places in the COVID-delayed 2020 Summer Olympic and Paralympic games in Tokyo cemented a surge in performances over the last few Olympic cycles. This followed a breath-taking second-place finish in the medal table at both the 2016 Rio Olympics and Paralympics, with a total of 27 and 64 Gold[1] medals (from 67 and 147 total medals won) respectively underlining these improvements at the highest level. Preceding Rio, the London 2012 Summer Olympics were a resounding home Olympics with Team GB (the moniker given to the team comprising Great Britain and Northern Ireland) achieving a third-placed position in the medal table (a total of 65 medals, including 29 Gold). This was followed by an equally impressive performance by the Home Nations, particularly England[2], at the 2014 Commonwealth Games. To place these successes in context, Team GB were the first nation in modern Summer Olympics history to eclipse the number of medals won at a home Olympics at the following games.

In terms of success aside from the Olympics, several notable performances have been achieved in the 21st Century. Sir Bradley Wiggins, Chris Froome and Geraint Thomas have won multiple editions of the Tour de France (2012-2013, 2015-2018) between

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[1] Traditionally, total number of gold medals (rather than total number of medals) has been used as a metric of performance at both the Summer and Winter Olympic Games and official medal tables are ordered accordingly.

[2] Whilst UK Sport provides the funding for British Olympic Athletes, much of this funding is demarcated to athletes who reside and train in England between Olympic cycles. As such, an emphasis on England and English athletes should be assumed within this thesis.

them, the most prestigious multi-day race in professional cycling, and Sir Andy Murray and his brother Jamie finished the 2016 sporting year as World Number Ones in Men's Singles and Doubles Tennis respectively, helping Great Britain to victory in the 2015 Davis Cup, Great Britain's first in 79 years (losing in the semi-finals to eventual winners Argentina in 2016 and to Spain at the same stage in 2019 along the way). England Netball achieved a standout Commonwealth Games Gold medal in 2018 and a creditable third place finish in their home World Cup in 2019, the England Men's and Women's Football teams both reached semi-finals of their respective World Cups in 2018 and 2019 respectively, as well as the Men's team following this up with an appearance in the delayed 2021 European Championships final, the England Men's and Women's Rugby Union teams reached World Cup Finals in 2019 and 2017, and the England Men's and Women's Cricket teams won their 50-over World Cups in 2019 and 2017 respectively.

In terms of success measured by outstanding performances, and consistent levels of success in major competitions, British sport has succeeded in an era where there is greater global competition than at any point in history. So, what are the reasons for these changes in fortune? Whilst some of the additional medals won by Team GB in Rio 2016 could be accounted for by the exclusion of athletes from the Russian Federation by many of the sports (including a total exclusion from the Paralympics), owing to doping violations, and in London 2012 and Glasgow 2014 to so-called 'home advantage' (Wilson & Ramachandani, 2018), it is likely that other factors underpinned this success, including significant increases in funding and a post-hosting effect from the 2002 Commonwealth Games in Manchester (Nevill et al., 2013). The role of sport

science, a complementary service that often accompanies the more established support of physiotherapy and sports medicine, cannot be underestimated in the context of this success in the UK (Haff, 2010) despite reservations about the impact that the sport science disciplines have in some sports (e.g., Andrade et al., 2021).

The Value of Sport Science to Sport

Sport science, defined as 'the application of scientific principles to the promotion, maintenance, and enhancement of sport … related behaviours.' (BASES, 2019, pg. 6), is traditionally categorised into one of three distinct, discipline-specific areas of study, namely exercise physiology, sport psychology and biomechanics. It is these disciplines that form the basis of the 'science' taught in National Governing Body (NGB) coach certification courses and taught sport coaching programmes in further and higher education and is offered in the literature as a characteristic contributing to the success of many leading nations at an elite sport level (Digel, 2002; Houlihan & Green, 2005; Sotiriadou & De Bosscher, 2013). Despite these observations, a growing body of evidence suggests that this is not the case globally, with several practitioners highlighting the paucity of applied sport science delivery in countries such as the USA and Asia (Stone et al., 2004; Haff, 2010). Indeed, Houlihan and Green (2005) have stated that '…sports have been fairly slow to explore the potential of sport[s] science in relation to competitors.' (pg. 176-177). The primary reason for this was the assertion that countries used their elite sport funding on the development of facilities and direct athlete funding, rather than support services (though other contributing factors, such as accessibility and availability of the workforce may also contribute to this).

Despite continued financial and organisational investment in sport science and medicine support in the UK (e.g., Alfano & Collins, 2021, Nevill et al., 2013), and acknowledgement that support services such as sport science could be central to success at the highest level of performance (e.g., Green & Houlihan, 2005; Waters et al., 2019), there is limited substantive evidence to support the view that sport science offers the difference between winning and losing in global sporting competition. Indeed, to date no empirical evidence exists to suggest that investment in sport science services offers an advantage in outcome (i.e., better performances at major sporting championships) over countries where no such investment is made. Much of this uncertainty could be attributed to the complexities of predicting sporting success at a global level. That is to say, if Governments and NGBs were able to determine what they needed to invest in to be successful, all major sporting powers would already be doing it. Notwithstanding this, UK Sport still invests significant amounts of resource into sport science support and research, as well in major facilities to support this work such as the English Institute of Sport network (UK Sport, 2020).

Coaches Understanding and Use of Sport Science Knowledge

Since the early 2000s, research interest in coach learning and education has increased significantly, most likely owing to the increased investment and attention in establishing large-scale coach education programmes in countries such as Australia, Canada, and the United Kingdom (UK) (Kolic, 2018). However, research examining how coaches understand and utilise sport science knowledge gleaned from coach education in their day-to-day practice is scarce, with the majority of coaches identifying informal means of learning and 'closed circle' networks as their primary

sources of new information rather than from sport scientists and the sport science literature (e.g., Reade et al., 2008a, 2008b; Piggott, 2012), in part owing to the limited transferability and relevance of formal coach education to their practice (e.g., Townsend & Cushion, 2017). In further support of this, Nash and Sproule (2009) conducted an interview-based study exploring a variety of coaching-related themes and their impact on coaching success at the elite level. The coaches raised concerns regarding formal coach education methods in the UK and that most of their knowledge around sport science and medicine was acquired through networking and informal methods of education, where coaches prefer to mentor and support each other's educational needs rather than seek external support. More recently, Stoszkowski and Collins (2016) observed that coaches prefer informal learning activities but still identified more formal coach education courses to gain access to knowledge. A trend exists in the literature that suggests an unpredictable relationship between the procurement of sport science knowledge and its application in sport coaches.

As part of a PhD programme in Australia, Williams and Kendall (2007a) reported the main differences between sport coaches and sport scientists were preferred methods of communicating and keeping up to date with recent developments, with coaches specifying a preference for coaching conferences and sport-specific magazines while scientists preferred the perceived additional integrity of peer-review publications. Notwithstanding these differences, both coaches and sport scientists agreed that more effort should be made for data and current good practice to be published in more easily understood language. This is further reinforced by the same authors

(Williams & Kendall, 2007b), who reported that only 3.6% of research conducted in Australia between 1983 and 2003 were reported in a case-study (i.e., coach-friendly) format and further implied by Martindale and Nash (2013), who reported the main barriers to sport science implementation by UK coaches to be relevance, access and language used.

In a roundtable discussing the current and future impact of sport science on sports performance, Haff (2010) reports that experts from around the world agree with a number of the conclusions drawn from the work by Williams and Kendall (2007a) and Nash and Sproule (2009). Specifically, Haff (2010) describes the problems associated with poor communication between researchers/practitioners and coaches, identifying coaches' limited knowledge of sport science as being one of the main problems. Bishop (contributing to Haff's roundtable) proposed a framework for bridging the gap between the scientist and coach suggesting a more cohesive approach to solving problems in high-performance sport. Specifically, Bishop (2008; Haff et al., 2010) proposed that coaches and scientists work together on determining research questions and that data and findings from such studies are reported in both scientific and coach-friendly publications (also Bishop et al., 2006; Nkala, 2019). Although the framework proposed was not theoretically driven, it does further reinforce the dichotomy between coaches' perceived needs and understanding of research, and sport scientists' approaches to research, translation of knowledge and practice.

Sufficient evidence exists to support the suggestion that there is a discrepancy between the perceived knowledge needs of sports coaches and the research and

practice being conducted by sport scientists, particularly at a higher level. Furthermore, this discrepancy is likely to be a result of several different, but interrelated, problems including the degree of sport science knowledge that coaches have, the perceived lesser value of research findings being published in alternative formats to peer-reviewed journals, and the need for coaches and scientists to work together in designing appropriate research questions. Fundamentally, these differences can only be explored once a clear understanding is achieved of how sport coaches value, access and learn from sport science knowledge. The role of National Governing Bodies and further and higher education is an essential component of this understanding.

Therefore, the purpose of this body of work was to foster a better understanding of sport coaches' perceptions of and access to sport science knowledge, to explore any barriers to successful application of this knowledge in real-world settings, and to identify the role that NGBs and FHE have to play in this. The first study will employ a qualitative research design, employing loosely structured interview as its main data collection method, with expert coaches. Williams and Kendall (2007a) used the same methods in the second stage of their study with similar-level participants, while Nash and Sproule (2009) used an unstructured interview for the purposes of their data collection. Much of the literature on type and style of interview has focused on the benefits and limitations of the different approaches (i.e., structured, loosely- or semi-structured, unstructured) in relation to the goals of the research and intended output. For example, Cohen et al. (2007) suggest that the loosely structured approach offers the best balance between spontaneity and exploration of issues with degree

of experimental control. Once perceptions and barriers to access and understanding of sport science knowledge have been better understood, and in order to position the research in the author's professional domain, a second study will adopt a mixed methods survey approach to data collection with a larger sample of coaches' representative of all levels of qualification, with a view to understanding the value and preferred location of sport science knowledge within coach training and education curriculum. A clear advantage of adopting such an approach is the opportunity to gather information in a wider population, whilst also limiting researcher bias.

Aim

To investigate coaches' perceptions of accessing and acquiring sport science knowledge.

Objectives

Explore expert sport coaches' perceptions of sport science knowledge.

Develop a better understanding of how coaches' access this knowledge.

Identify any barriers/challenges pertaining to bridging the gap between access and implementation of sport science knowledge in sport coaching practice.

Inform coach training and education practices in National Governing Body and further and higher education settings.

Researcher Bias

The primary researcher was a Sport and Exercise Scientist, as student, academic and practitioner, between 1998 and 2018 and a qualified sports coach in several sports for the past twenty-five years. In designing these studies and gathering the data, attempts to reduce researcher bias were made whilst making use of this professional and vocational knowledge in determining the focus of the interviews and survey, for example the preparation of the questions to be asked and/or offering context or an alternative perspective to participants during the interviews for the first study. The potential for bias was reduced by the researcher undergoing significant training to ensure that skills appropriate to interviewing, survey design and analysis of qualitative and quantitative data were acquired prior to instrument design, and data collection, reduction, and analysis.

Summary of the Chapter

Significant improvements in sporting performance, as measured by winning more medals and achieving higher rankings, have been seen in British sport over the past decade. Whilst some of this success may be attributed to features homogenous with all global sport, such as the amount of financial investment and the hosting of major competitions, it does not fully explain how the most valuable commodity in sport - the athletes - are supported to achieve their full potential at an individual/team level. Accompanying these successes has been a large investment in complimentary services such as sport science. However, despite this investment, limited evidence exists to suggest that increased use of sport science result in improvements and success in sport. Indeed, much has been made of the paucity of high-quality sport

science around the world, questioning whether this investment is required to achieve the success so craved by the British public. Furthermore, limited evidence exists (beyond mostly anecdotal) to suggest that sport coaches (those with the responsibility to develop and sustain levels of athletic performance) can access and appropriately understand the sport science knowledge acquired from this investment effectively. It is therefore the primary aims of this thesis to explore how sport coaches' access sport science knowledge, to identify any potential barriers to successful application of this knowledge in their professional domain, and to establish the role of both further and higher education and NGBs in sport science coach education, training, and learning.

Review of Literature

In accordance with Davies's (2004) suggested purposes of a literature review, namely putting the topic in context, and defining key concepts, this review will begin by discussing the role and function of coach education and training, whilst operational definitions of coach education and training will offer some context as to the current 'state of play' in this field. The review will then establish a greater understanding of the target population through describing the sport coaching workforce in the UK, before continuing to discuss the UK's sport coaching qualification framework and the sport science curriculum contained within both NGB sport coaching certification and qualifications in sport coaching through further and higher education. This will be followed by a review of the literature specifically exploring expertise in sport coaching. Given the importance in this research to the acquisition and implementation of knowledge, the review will then consider definitions of knowledge and learning, the types and sources of knowledge employed by sports coaches, and a review of the literature exploring how sport coaches both access this knowledge and learn from it. Finally, a review of the literature examining sports coaches preferred and actual sources of knowledge will be presented, whilst discussion surrounding expectations of sport coaches will also be provided with specific reference to sport science knowledge and application. This will include research examining sport coaches' perceptions of sport science, knowledge obtained from sport science, and any observed barriers to effective application of sport science knowledge will be considered in the context of British sport coach training and education.

Context

As Sport Coaching has sought to become a profession, rather than a subset of the longer standing vocation of Physical Education teaching, research into coaching has increased exponentially. For example, the first academic publication dedicated to Sport Coaching, the *International Journal of Sport Science and Coaching*, had its inaugural edition published in March 2006. In their review of literature exploring coaching science as a subject area between 1970 and 2001, Gilbert and Trudel (2004) determined that a mean of only 1.8 articles were published a year in the 1970s with a steady increase into the 1990s to approximately 30 articles per year. A cursory glance of any literature search engine using 'sport coaching' as keywords demonstrates this increase even further, with a rise from 35 articles published in 2007 to c.4600 in 2020.

Early attempts to understand expertise in sport coaching explored coach effectiveness through a variety of behaviourist approaches and methods, including self-analysis and reflection, systematic observation and survey (e.g., Douge & Hastie, 1993). In their review of the literature, Douge and Hastie (1993) discuss the established coaching behaviours necessary for successful sport coaching, such as feedback, questioning, and observation. These early forays into sport coaching identified effectiveness requirements related to age, gender, type of sport and level of performance, suggesting that expertise was situation-, domain- and context-specific (Nash et al*., 2012). In part owing to the over-simplistic ways in which early behaviourist research had characterised expertise, research began to explore the *why* rather than the *how* (Lyle & Cushion, 2017).

Introducing Coach Education and Training

Education, training, and learning seeks to prepare individuals for occupational practice in any professional vocation (e.g., Lyle & Cushion, 2017). In the context of sport coaching this includes, but is not limited to, the preparation, delivery and evaluation of practice drills, tasks and activities to develop a participants' understanding of a sport or physical activity and their role within it, relationship development, coaching practices, and coach education and development (Callary & Gearity, 2020). Personal and social elements are also incumbent on the role. In addition, and of particular importance in the context of this thesis, sport science curricula also inform the knowledge and practice of coaches (North et al., in press). As such, the future standard bearers of any profession are influenced by the quality of such provision and understanding the impact that learning and training have on sports coaches is a key ingredient in this.

As discussed by Lyle and Cushion (2017), greater conceptual clarity is required to foster a more informed approach to the education and training of sports coaches. Amongst their criticisms, Lyle and Cushion (2017) observe the lack of definitional clarity prevalent in the coach education and development literature, citing examples of where terms such as coach training, coach education, coach certification, and coach development have been used interchangeably and often uncritically. For example, the term coach education is frequently used to describe formal provision in the form of NGB coaching certification. However, given the prescriptive and mechanistic nature of such programmes, where standardised curricula are presented to the participants, coach training may be a more appropriate term.

This is aptly observed by Bales et al. (2020), who suggest that most coach training programs are delivered '…with insufficient consideration to both the application of the learning and the effectiveness of the coach or their practice' (pg. xvii). Though these authors continue to suggest that development of the International Coach Developer Framework (ICCE, 2014) shifted this emphasis, describing the role of the coach developer in a more encompassing way that looked beyond just formal settings such as the traditional coaching courses described above, it is the contention of this author that most British NGB coaching certificates (at the introductory level, at least) would still be best described as coach training rather than education.

In summarising, the distinction between coach training and coach education is that training promotes uniformity whilst education encourages variability through exploring individual learners understanding of the knowledge and skills being presented (Cushion and Nelson, 2013). It could be argued that this also offers a glimpse into a key difference between NGB and further and higher education-led coach training and education (e.g., Dixon et al., 2021), and substantiates observations made by Gilbert and Trudel (2009) about the discrepancies between the level of education and practical experience required by trainee teachers when compared to sport coaches. Viewed in this way, coach training provides the most consistent (and arguably therefore most reliable) method of ensuring that participants achieve minimum levels of competency. Indeed, much of the attempts in the UK to align NGB coaching certificates to National Vocational Qualifications (NVQs) stem from the desire to define sport coaching in terms of occupational standards that satisfy the safety and welfare needs of participants. The biggest limitation of such an approach

is that the coach is denied choice and instead offered a prescriptive, NGB-led doctrine of expected values, attitudes, and approaches to planning, delivery and evaluation of their practice (e.g., Nelson et al., 2006; Chesterfield et al., 2010). For the remainder of this thesis, 'coach training' will be used to describe NGB coach certification and 'coach education' will be used to describe qualifications obtained through further and higher education.

The Coaching Workforce

Recent developments in our understanding of the coaching workforce in the UK come from a series of research activities with stakeholders in the sport and physical activity sectors. Of these, the Coaching in the UK Coach Survey (Thompson & Mcilroy, 2017; Thompson et al., 2020), and Sport England's Active Lives Adult Survey (various years) offer the most relevance and insight, as well as offering a unique lens into how the population has evolved over time.

Thompson et al. (2020) report the findings of the biannual UK Coaching-commissioned piece of research conducted by YouGov, exploring the coaching workforce across the sport and physical activity sector in the United Kingdom. Of the participants surveyed, an estimated 6% of UK adults (approximately three million people) reported that they had guided sport and physical activity in the twelve months prior to the survey. Of these, over half (54%) reported that they did not have a formal coaching qualification. Although this finding is alarming, it does demonstrate a statistically significant improvement over the same survey conducted in 2017 (Thompson & Mcilroy, 2017) where 58% of coaches reported this. Most of these newly qualified coaches were those undertaking introductory level (i.e., Activator or

Level 1) qualifications to support the delivery of sessions to children by more-qualified coaches, rather than the guidance and delivery of sessions themselves. At the high-performance level, 74% reported being qualified, with 18% possessing a United Kingdom Coaching Certificate (UKCC) Level 3 or Level 4 coaching qualification. Though NGBs of sport have made significant strides to improve the regulation of coaching, it continues to be an area for increased attention and concern (Twitchen & Oakley, 2019) and is a recurring theme throughout this thesis.

Insightful in establishing the scale and magnitude of the coaching workforce, the Coaching in the UK survey (Thompson et al., 2020) also provides some interesting perspectives on coaches' motivations and potential barriers to their ambitions in the vocation and suggests some challenges pertinent to coach education and training. When asked for their views on the greatest challenges to coaching, survey respondents identified cost of training (36%), balancing other commitments (36%), and the voluntary nature of the role (31%) as the main barriers. When specifically examining those that coached talented or high-performance athletes, the voluntary nature of coaching as a barrier rose to an astonishing 53%. Length of time to undertake qualifications (17%) and lack of opportunity to undertake Continued Professional Development (CPD, 15%) were also mentioned. In relation to coach development, 7% of those that coach or who have previously coached described their role as involving some sort of coach development, either as a mentor (38%), coach developer (20%), or coach educator/tutor (13%). In addition, 14% of coach developers possessed a relevant university degree or diploma and a clear majority (73%) also coached themselves at a club/academy level. Similar to the rest of the

coaching workforce, the voluntary nature of the role (34%), lack of investment in facilities and equipment (34%) and balancing work/home life were the three main barriers to coaching identified by coach developers.

Broadly speaking, the findings of Thompson et al. (2020) are supported in the most recently published pre-COVID 19[3] Active Lives Adult Survey (data gathered between November 2018 and 2019), who reported that 13.4% of adults in the UK volunteer in some capacity to support sport and physical activity, of which 37% do so as coaches or instructors (Sport England, 2020. If we were to extrapolate this finding using current UK population statistics, this figure equates to approximately 2.7 million adults coaching sport and physical activity in the UK. This figure is likely inflated by those that casually coach/provide guided sport on an infrequent basis (i.e., less than once a month), and therefore a more sensible estimate would be approximately 1-1.2 Million adults regularly involved in the coaching of sport in the UK (see North, 2009 for further discussion). Only 11% of those that volunteered were from lower socio-economic backgrounds, supporting the findings of Thompson et al. (2020) identifying cost as being a potential barrier to involvement.

The United Kingdom Coaching Certificate (UKCC)

At time of writing, the majority of NGBs and sports federations require that their coaches possess or are working towards a coaching certificate embedded within the UKCC (United Kingdom Coaching Certificate) framework (Sportcoach UK, 2012).

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[3] During the COVID-19 pandemic, these surveys focused less on volunteering (and therefore coaching) and more on outcomes associated with attitudes, loneliness and mental health benefits of sport and physical activity

Resulting from recommendations from the Coaching Task Force report in 2002 (DCMS, 2002), following introduction in the UK of National Vocational Qualifications (NVQs) in the mid-1990s, the UKCC was developed as a standardised and centrally organised coach education programme with the aim of advancing the quality of sport coaching with a future aspiration of professionalising the vocation, though this ambition has evolved since the development of the UKCC and recent changes in the strategic vision for coaching in the UK (Sport England, 2021). Consisting of four distinct levels, coaches are able to progress from Level 1 (Coaching Assistant/Activator), through Levels 2 and 3 (Session Coach and Club Coach), to Level 4 (Performance Coach). In some instances, NGBs have also established a Level 5 (Master Coach).

In contrast to Levels 1 through 3, which are administered and delivered solely by NGBs and their network of tutors, UKCC Level 4 is a collaboration between Higher Education Institutions (HEIs) and NGBs. For example, the British Judo UKCC Level 4 is delivered in partnership between the NGB and Sheffield Hallam University (the author's academic affiliation and employer). Though not exclusively, most of the candidates for Level 4 are those that are already in possession of a Level 3 and are nominated by their NGB and are therefore experienced and often in paid coaching roles with higher-level athletes. Another example of a UKCC Level 4 partnership is between British Canoeing and the University of Stirling (Kolić, 2018). UKCC Level 4 is benchmarked against both sport (i.e., NGB) and postgraduate (Level 7) learning objectives, with candidates who complete it achieving a Postgraduate Diploma (PgDip) from the awarding HEI as well as their Level 4 certification. The content of

these programmes is aligned to satisfy the requirements of the sport and its coaching practice (e.g., coaching philosophy, professional development etc.) and the sport science that underpins high-level success (e.g., psychology, performance analysis, biomechanics etc.). It is worth noting that, in some cases, successful completion of the PgDip does not guarantee candidates being awarded the Level 4 UKCC, since further work in the form of a professional portfolio is often required to separately satisfy these requirements.

In addition, though candidates are undertaking postgraduate-level study, educational background is not always considered as part of the selection and recruitment process. Rather, previous relevant experience is considered, in a comparable way to how HEIs will support students submitting APEL (Accreditation of Prior Experience and Learning) applications in lieu of qualifications, particularly in disadvantaged or priority groups. This is in contrast to more traditional postgraduate recruitment, whereby the majority of students will have undertaken undergraduate degrees before embarking on Level 7. For comparison, all sport coaches in Brazil must possess a bachelors (i.e., undergraduate) degree before they can begin coaching (Trudel et al., 2020). It is not within the scope of this review to elaborate in too much detail on the UKCC Level 4, but readers are referred to the postgraduate work of Kaur and Kolić (Kaur, 2014; Kolić, 2018; Kolić et al., 2020) for an insightful and detailed critique and account of candidates' experiences of the UKCC Level 4 across a variety of sports (Judo, Canoeing, Rugby League, Hockey, Squash, Basketball and Table Tennis) delivered at three separate HEIs.

A number of pitfalls of the UKCC approach have been highlighted by, amongst others, Lyle and Cushion (2017) and Twitchen and Oakley (2019), including the redundancy of a functional competency approach to coach training in real-world settings and disregarding the importance to learning of the interaction between the participant (i.e., the coach) and the curriculum. More broadly, Raggatt and Williams (1999) emphasise the prohibitive effect of much of the language used in describing NVQ qualifications in the UK, whilst Twitchen and Oakley (2019) suggest that continued ownership of lower-level coaching qualifications by NGBs, and their reluctance to relinquish control, offers further challenges to the ever-evolving demands placed on coach education and development.

As well as a broader definition of what coaching is (including recognition of the role of lower-level activator in encouraging participation in physical activity through sport), Sport England's (2016) *Coaching in an Active Nation*, closely followed by UK Coaching's (2018) *Transforming Learning, Transforming Lives* strategy and the latest *Uniting the Movement* strategy recently released by Sport England (2021), sought to address some of these criticisms, with acknowledgement of the importance of coaches owning their own development, and recognising the value of learning through informal means, such as observation, mentoring, and peer relationships. Twitchen and Oakley (2019) suggest that the UK driving test, arguably the largest and most accessible learning and assessment system in the country, is analogous to what coach training and education should aspire to, namely that individuals construct their own learning in preparation for summative assessment, that this learning can take many different forms and take different lengths of time dependent on the individual,

and that assessment takes place in a real-world environment where the required standard must be met.

Though the functionality of the UKCC has been questioned as an effective means for the development of competent and inquisitive sport coaches, it is this standard that is the predominant approach currently employed by NGBs to regulate their coaching workforce. Criticisms include the perception that it is too prescriptive in approach, lacking clear standardisation both across and within sports, and inconsistency of practice (e.g., Twitchen and Oakley, 2019). Another criticism, discussed in more detail later in this literature review, is the over-reliance on formal methods of coach education, which have been cited as being both insufficient and inadequate in developing coaches beyond a surface level of understanding (e.g., Gilbert et al., 2010).

The Sport Coaching Curriculum

As recently as 2020, the coachforce21 baseline report comparing coaching systems in the member countries of the European Union (Lara-Bercial et al., 2020) observe that the United Kingdom does not currently have a specific set of laws governing coaching and volunteering (though these are addressed indirectly through other legislation related to safeguarding of children etc.) and, more importantly in the context of this thesis, possess a licensing system, coaching register or a regulated professional register. As Callary and Gearity (2020) observe '…is it not shocking that much sport coach education is unregulated, haphazard and informal?' (pg. 1). The UK is not alone in this, with Lara-Bercial et al. (2020) reporting issues related to regulation, namely the presence of a licensing system, and alignment of qualifications

across sports/participant groups and the tracking of coaches being mixed across all the member countries, with only 37.5% being able to provide data related to work status of their coaches as an example.

In recognising the need to implement a wider systems approach to the understanding, and subsequent improvement, of sport coaching standards, several scaffolded frameworks have been put in place to support the development of coaching systems. Of these, the International Sport Coaching Framework (ISCF; ICCE et al., 2013) and European Sport Coaching Framework (ESCF; Lara-Bercial et al., 2017) are notable and worth discussing in the context of this thesis. The ISCF was intended as a benchmark for the recognition and certification of coaches across the globe and has been described as offering a step change in ways that coach training and development are understood and designed (Lara-Bercial et al., 2016). As such, the framework provides a set of common principles and concepts that can be applied as the needs demand, in a variety of different contexts, sports and countries. Several prominent features of the framework are worth discussing here, both to provide context and to offer the reader an appreciation of the vision and direction of sport coaching across the UK and globally.

Firstly, the ISCF (ICCE et al., 2013) acknowledges both level of coaching and target population (either participation or performance), whilst also recognising the status of coaches based on their employment. Secondly, the framework proposes a common language to foster greater coach mobility. Finally, the ISCF assists in mapping coaching competencies against roles, and seeks to enhance the effectiveness of sports coaches by defining minimum standards for certification.

Whilst the framework offers succinct descriptions of the coaches' role (described elsewhere in this review as part of the description of the UKCC framework), focus and responsibilities, this review will focus on Chapters 6, 8 and 9 of the framework, namely 'Coaching Knowledge and Competence', 'Coach Development', and 'Coach Certification and Recognition', since these are the most relevant to the aims of this thesis.

When describing areas of knowledge, the ISCF recognises the work of Gilbert and Côté (2013) who suggest three categories of coach-specific knowledge: professional, interpersonal and intrapersonal. The primary focus of this thesis, sport science, is encompassed within the professional knowledge domain, along with coaching theory and methodology and knowledge pertaining to the sport and the athletes, whilst interpersonal and intrapersonal knowledge describe the ability of the coach to emotionally connect with people and knowledge of self, values and beliefs respectively. Importantly, the ISCF promotes intrapersonal knowledge as a central tenet of effective sport coaching, where the coaches' philosophy and principles underpin the primary functions of a sports coach (see Figure 1). In describing coach development, the ISCF recognises both the longitudinal nature and the variety of experiences that contribute to this development, including athletic experience, experiences of coaching, and other forms of informal and formal education (e.g., coaching certification such as the UKCC and further and higher education offers in sport or PE, such as an undergraduate degree in Sport Coaching). In doing this, the framework recognises the complexity and non-linear nature of coach development
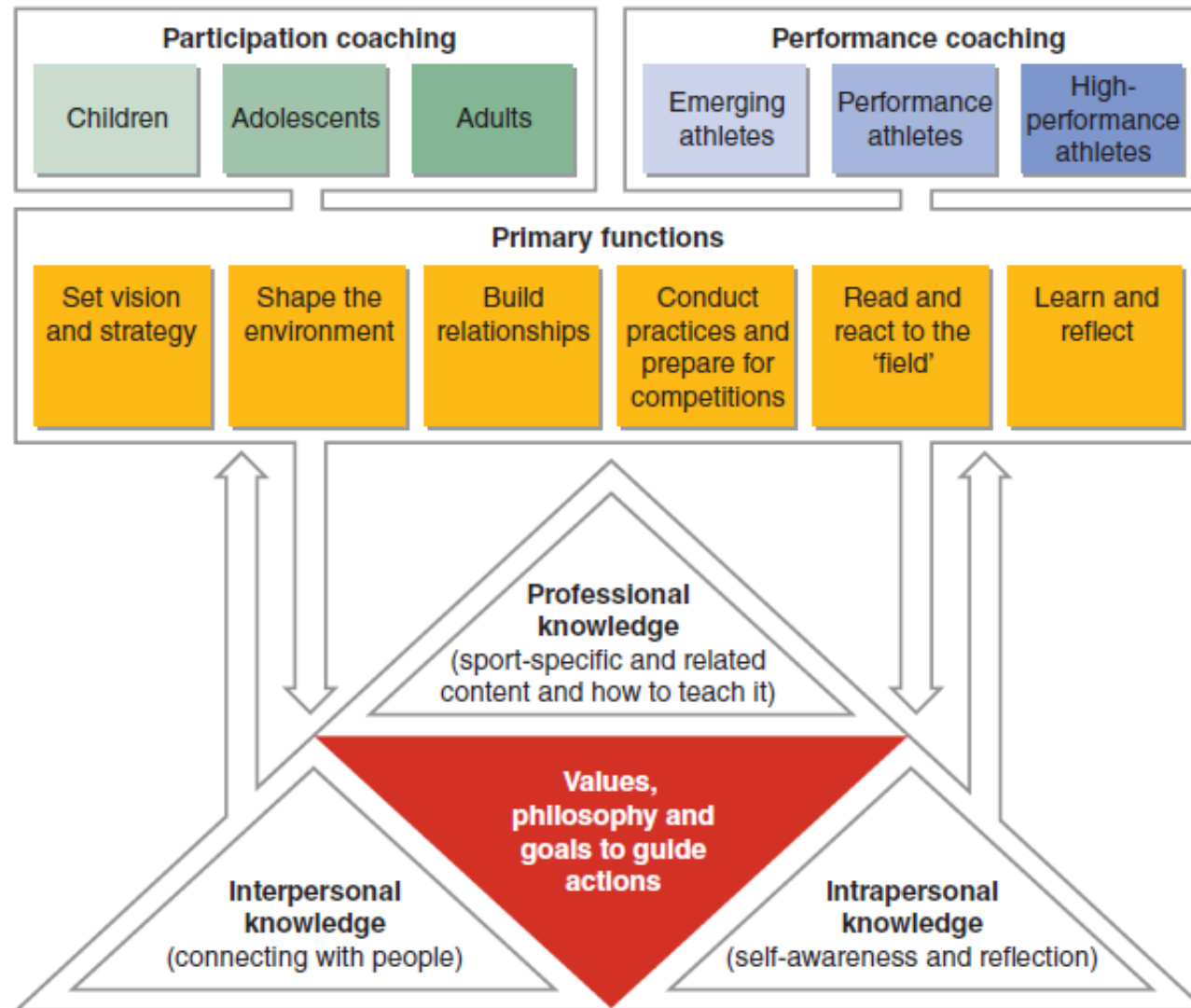
Figure 1: Functional Coaching Competence and Coaching Knowledge (from ISCF, pg.31)

highlighting a variety of learning opportunities as examples of how and where coaches may develop.

When discussing regulatory components of sport coaching qualifications, the ISCF recognises the importance of quality assurance of coach certification and licensing. A recommendation of the framework is that HEIs and sport federations (i.e., NGBs) foster relationships to enhance the quality and relevance of provision. In addition, the ISCF presents a model showing how coach education might align to HEI-provided awards, suggesting that a Level 3 Advanced/Senior Coach award is aligned to a university diploma or degree. Significantly, the ISCF suggest that development of clearer coach education pathways will allow for systems of coach licensing to be introduced. Lara-Bercial et al. (2017) report that countries such as Japan, Brazil, the United States, and South Africa, as well as global sports federations in Tennis, Golf and Triathlon, have all used the ISCF to develop and sustain their coaching systems since conception.

Building on the ISCF, the ESCF (Lara-Bercial et al., 2017) set out to develop an enhanced version of the ISCF for European member states. Intentionally, the authors explain how the ESCF was not intended to replace the ISCF, rather seeking to contextualise the ISCF for a European audience. As such, much of the ISCF is mirrored in the ESCF with one or two notable exceptions. Two such examples are how the ESCF extends the ISCFs chapter on 'Coaching Knowledge and Competence' by exploring contemporary features of coaching expertise, citing Schempp et al.'s (2006) work on the development of expert coaches (see the section titled 'Expertise in Sport Coaching' for further discussion), and Abraham et al.'s (2015) 'Who, What, How'

model to describe the knowledge requirements of sport coaches. In addition, the framework discusses the ambition for sport coaching to be professionalised, in part to increase the recognition and representation of coaches but primarily to guarantee a minimum level of quality in the coaching workforce.

Though coach training has received considerable attention through the publication of the ISCF and ESCF, undergraduate sport coaching degrees are the focus of the 'ICCE (International Centre for Coaching Excellence) Standards for Higher Education: Sport Coaching Bachelor Degrees' (ICCE, 2016). In acknowledging the role that further and higher education plays in advancing coaching through research and taught provision, the ICCE present these standards as the minimum threshold for bachelor (i.e., undergraduate) degrees in the same way that the ISCF and ESCF describe them for coaching qualifications. Elaborating on the ISCFs professional knowledge domain, the standards identify four distinct sub-domains, namely 'Understanding the Process and Practice of Coaching', 'Understanding the Context', 'Understanding the Sport and Sport Curriculum' and 'Understanding the Participant' (pgs. 19-20), with traditional subjects of sport science located in the final two sub-categories. In addition, certain aspects of sport science are situated in the intrapersonal and interpersonal knowledge domains in the form of psychology and skill acquisition/motor learning theories (see Tables 1a and 1b for a schematic highlighting the location of sport science knowledge within the ICCE bachelor degree standards).

Table 1a: Modified schematic identifying core sport science knowledge contained within the Professional Knowledge Domain of the ICCE Standards for Higher Education: Sport Coaching Bachelor Degrees' (ICCE, 2016)

	Sub Domain	Broad Theoretical Areas	Exemplar Areas of Study
Professional Knowledge	Understanding the Sport and Sport Curriculum	Theories of Technique	Biomechanics
			Motor Control
			Skill Acquisition
		Theories of Tactics and Strategy	Cognitive Psychology
			Decision Making
			Notational Analysis
		Theories Psychological Demands	Performance Psychology
			Sport Psychology
		Theories of Physiological Demands	Performance Physiology
			Strength and Conditioning
			Motion Analysis
			Sports Nutrition
			Sport Injuries
		Theories of Movement Demands	Motor Control
			Motor Development
			Functional Movement
	Understanding of the Participant	Biological Theories	Anatomy
			Developmental Physiology
			Exercise Physiology
		Psychological Theories	Sport Psychology
			Performance Psychology
			Motivational Theories
		Sociological theories	Group Dynamics
			Group Theory
			Socialisation Theory
		Participant and Talent Development Models	Bio-Psycho-Social Models of development

Table 1b: Modified schematic identifying core sport science knowledge contained within the Intrapersonal and Interpersonal Knowledge Domains of the ICCE Standards for Higher Education: Sport Coaching Bachelor Degrees' (ICCE, 2016)

	Sub Domain	Broad Theoretical Areas	Exemplar Areas of Study
Intrapersonal Knowledge	Understanding of Self	Theories of Self-Regulation Theories of Values and Beliefs Theories of Personal Development Theories of Coaching Research and Knowledge Generation Theories of Coaching Research and Knowledge Generation	Developmental Psychology Reflective Practice Metacognition Epistemology Mental Skills Self-Regulation Research Methods Sociological and/or Psychological Interpretations of Coaching Positive Youth Development
Interpersonal Knowledge	Understanding Human Relationships & Pedagogy	Learning Theories Skills Acquisition/Motor Learning Theories	Cognitive Learning theory Social Learning Theory Sociological learning theory Experiential Learning Theory Self-Directed Learning Theory Transformative Learning Theory Ecological/Constraints Theory Information Processing Theory

In the context of this thesis, it is worth highlighting how the ICCE standards discuss the level of coaching expected by graduates from these courses. As part of the practicum profile set out in the standards, this equates to significant on-the-job experience in terms of opportunities to plan, lead, deliver and evaluate coaching sessions in a variety of settings, as well as contributing to the preparation of participants and athletes for organised competition. With this in mind, and specifically referring to the alignment between coaching qualifications and higher education awards outlined on the ISCF, it is suggested that the minimum level of coach graduating from an undergraduate sport coaching degree is equivalent to UKCC Level 2 with some able to achieve Level 3, based on previous experience and entry profile. As such, when contrasting the ISCF/ESCF and the ICCEs bachelor degree standards, it is evident that some incongruence exists between expected levels of knowledge (sport science in this context) obtained by Level 2 coaches completing NGB coaching certification/training and those completing undergraduate sport coaching degrees in the UK.

In recent years, the Chartered Institute for the Management of Sport and Physical Activity (CIMSPA) has also gained traction in UK sport coaching with the publication of their professional standards for Coach/Senior Coach (CIMSPA, 2019) and Coaching in High-Performance Sport[4] (CIMSPA, 2020) and their government-commissioned role in regulating undergraduate sport coaching degrees through their endorsement process. CIMSPA received its chartered status in 2013 following a long history of

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[4] For succinctness, this thesis uses the high-performance environmental specialisms, though the reader could reach the same conclusions and inferences for any of the three specialisms described by CIMSPA (see page 42)

servicing professionals allied with the sport and physical activity sector. Building on recognition of the organisation as the lead in the implementation of a set of unified professional standards in the sport and physical activity sector in Sport England's *Sporting Future* (Sport England, 2015) strategy, CIMSPA were awarded £1.2M by Sport England to expedite this process and increase the impact of the organisation.

In addition, a partnership was announced between CIMSPA and the British Association of Sport and Exercise Sciences (BASES), the national body for sport and exercise science, in February 2018. Part of this was an agreement that BASES' current scheme to quality assure the content of undergraduate sport science degrees, the BASES Undergraduate Endorsement Scheme (BUES), would be recognised within the CIMSPA professional standards matrix. Agreement was also made between CIMSPA and UK Coaching to combine the Register of Exercise Professionals, a directory of quality-assured professional working in the fitness and personal training industries, with CIMSPAs own directory of exercise and fitness professional. HEIs are now able to achieve CIMSPA endorsement status for their undergraduate degrees by mapping CIMSPAs professional standards against degree curriculum for a large number of sport and physical activity professions, including sport coaching (CIMSPA, 2019, 2020).

The professional standards for sport coaching seemingly address those qualified to coach at Levels 1 and 2 (Coach) and those qualified to coach at Level 3 and above as a Senior Coach (Coaching in a High Performance environment), though some ambiguity exists around this given that the professional standards for Coach are an occupational standard whilst the professional standards for Coaching in High

Performance Sport are one of three environmental specialisms (along with 'Working in the School Environment (out of curriculum)' and 'Working in the Community Environment'). It is unsurprising that the professional standards for Coach are primarily focused on pedagogy, that of planning, leading, delivering, and evaluating guided coaching sessions, since it would be expected to be the primary role of a coach working at this level. However, it is significant that these entry-level (i.e., UKCC Levels 1 and 2) professional standards for Coach do not specify sport in the title. Rather, the standards emphasise the continued pivot towards the role of the coach as a facilitator of sport *and* physical activity. Though some limited sport science knowledge is implied in some of the knowledge and understanding sections of the entry-level professional standards, there are no specific examples of topics or disciplines of sport science knowledge addressed.

In contrast, the Coaching in High Performance Sport professional standards use the same knowledge domains outlined in the ISCF and ESCF (i.e., professional, intrapersonal, and interpersonal knowledge) to describe the knowledge and skill attainment expected of a coach working as a high-performance environmental specialist. Designed around six core (and mandatory) topics, sport science knowledge and skills are more clearly articulated with specific reference to traditional areas of sport science in the 'athlete/player development' and 'athlete curriculum' core topics. As such, it could be inferred that the knowledge contained in these professional standards are aligned to the ICCE bachelor degree standards, further supporting the observation by Trudel et al. (2020) about the role, function and value of undergraduate sport coaching (or equivalent) education.

CIMSPAs role in the regulation of further and higher education provision has come under scrutiny, with critics questioning the motives of an external organisation regulating further and higher education provision and the lack of autonomy that this presents (Aldous & Brown, 2021). Aldous and Brown (2021) suggest that this approach to university-level education dehumanises many of the strengths of universities in knowledge creation and application by having the potential to devalue criticality and other pillars of graduate status.

In summary, it is clear from the variety of vocational and education standards discussed here in the context of UK coaching that there is a place for sport science knowledge in the curriculum. However, what is less clear is the rationale behind the location of sport science in the later stages of coaches' development (i.e., Level 3 and beyond) when only a small number of sport coaches achieve this status. Though speculative, it could be concluded that work to-date modernising and informing sport coach training (NGBs) and education (further and higher education) practice has deemed that knowledge obtained from the sport sciences is not necessary at Levels 1 and 2 of the UKCC (or equivalent). It is the contention of this author that the late introduction of sport science knowledge to the curriculum of coach development is the largest barrier to effective coach-led implementation of this knowledge in the development and maintenance of performance levels in athletes and teams. It is this contention that forms the basis of the rationale for the primary focus of this thesis.

Knowledge: Definition and Theory

To understand how coaches' access and make use of sport science knowledge, it is first important to define knowledge and learning, discuss how knowledge is acquired,

and then determine how this applies directly and indirectly to sport coaches. Côté and Gilbert (2009) suggest that, whilst there have been many attempts to label the variables that describe effective coaching, one common variable can be used to collectively describe a coach's affective, behavioural and cognitive disposition: that of knowledge. Furthermore, Côté and Gilbert (2009) cite the use of Anderson's (1982) conceptualisation of knowledge as a useful way to understand how coaches employ knowledge in day-to-day activities. More specifically, Anderson (1982) put forward that knowledge can be represented by declarative (*knowing*) and procedural (*doing*) knowledge.

Declarative knowledge is information that is readily available, and typically related to particular subjects of interest. Examples might include many of the 'ologies', a term coined by Abraham et al. (2006) to describe the coaching sciences (psychology, sociology, biomechanics, nutrition, physiology and motor control; also, Nash & Collins, 2006), and 'how to' pedagogy, such as coach behaviour theory, motor learning, and critical thinking skills. Procedural knowledge, sometimes referred to as imperative knowledge, is the knowledge exercised in the undertaking of a task or series of tasks. As such, procedural knowledge offers the sports coach the opportunity to solve problems within a specific context and makes effective use of hands-on experience in its successful application. Abraham et al. (2006) propose appropriate selection and implementation of drills and practices, effective communication, and competition planning as being examples of procedural knowledge in a sport coaching setting.

Abraham et al. (2006) made attempts to model coaching, and with it a better understanding of coach development, in the form of a coaching schematic that could be used across multiple different coaching contexts and situations. Citing how professionals use broader structures of knowledge, referred to using Entwistle and Entwistle's (2003) 'knowledge objects' vernacular, Abraham and colleagues describe how sports coaches' decision-making is developed through a unique (i.e., individualised) integration of related *concepts* and *conceptions*. Concepts, most often communicated to recipients through traditional (i.e., structured and curriculum-based) training, are defined as those that are more easily articulated/verbalised, and therefore contain common declarative content and procedural application, such as generic 'how to coach' information typically delivered on lower-level coaching courses. In contrast, conceptions provide a method by which coaches can 'make sense' of concepts in a meaningful, situation- or context-specific way. This may involve comparing knowledge against belief systems or reflecting on previous experiences of similar situations and is usually difficult to describe and requires reflection and/or facilitation to provide meaning. Sport science knowledge might be considered an example of a concept that, without contextualisation to an individuals' own workplace setting, would be of little use to the practising sports coach.

Nash and Collins (2006) discuss Kreber and Cranton's (2000) research activity exploring types of knowledge in Physical Education (PE) teaching and observe that the three types of knowledge identified by Kreber and Cranton (2000) echo the knowledge required to be successful in coaching; instructional, pedagogical and curricular. Mirroring coaching, Nash and Collins (2006) recognise that teachers will

possess both sport-specific (declarative) and pedagogical (procedural) knowledge, and that less-experienced teachers will try to factor in every circumstance and variable to maintain control of the practice environment in doing so. Sport coaches will also possess additional knowledge, in the way of the 'ologies', and (in both cases) may require some form of 'conditional knowledge' to know when and how to access this (Nash & Collins, 2006, pg. 469). Interestingly, despite the similarities, where studies have examined PE teachers, coaches and those that undertake both, differences were consistently observed in the pedagogical characteristics of their respective roles (Hardin & Bennett, 2002).

Tacit knowledge, defined by Nash and Collins (2006) as '...knowledge gained from everyday experience that has an implicit, unarticulated quality' (pg. 470), has been suggested as being the most significant source of knowledge during competition and other stressful situations (Wood et al., 1990). Observations surrounding the use of tacit knowledge by sport coaches have been centred on the differences between novice coaches, who often make decisions based on irrelevant information or cues, and their expert counterparts, who seem able to respond to novel situations by utilising knowledge of previous experiences and outcomes. In recognition of this expertise, Sternberg (2003) suggests that expert coaches act in a more instinctive, reflexive, or intuitive way when compared to their novice counterparts.

Abraham et al.'s (2006) description of conceptions, previously discussed, could be offered as an example of tacit knowledge in that conceptions share many of the same traits as this type of knowledge; namely that they are difficult to describe, can appear to be unplanned (reflexive) and use previous experience to make sense of novel

problems, challenges and situations. Based on the observation that tacit knowledge is difficult to articulate, and therefore almost impossible to capture in a meaningful way to disseminate to others, Nash and Collins (2006) question how curriculum-based coach education, with an emphasis on declarative knowledge, can provide the optimal environment for the development of sport coaches, especially those at a higher level. This leads them to proposing a shift from coaches being 'parrots' (education develops the ability to mimic preferred styles of coaching) towards 'automatic' (independent of thought and action), increasing their (the coaches) ability to make use of procedural knowledge in-situ and in-context. A recurring theme throughout this thesis is this shift from didactic, instructor-led forms of coach development to those that are more constructivist and learner-centred.

Interestingly, Sport England (2016, 2021) implicitly refer to this in recent iterations of their coaching framework, suggesting that coaches will be assessed more in-situ, with their own participants and in their own performance environment (i.e., in the participants own sports club setting rather than via a simulated coaching experience at a venue selected to host a NGB coach certificate). This is further elaborated on by Twitchen and Oakley (2019), who propose an outcomes model of coach learning and assessment, where continuous formative feedback from mentors and peers facilitates coach development. Importantly, the approach proposed highlights a separation of learning from assessment, with summative assessment taking place when the coach deems that they are ready, as well as recognising the importance of the coach self-determining additional learning to accompany core learning required for safe practice.

Learning: Definition and Theory

In its broadest sense, learning describes how a participant (or learner) receives, assimilates, retrieves and retains knowledge. Importantly, cognitive, emotional, and environmental influences all mediate how and what the learner learns (or does not learn), and there are several different theories and philosophical standpoints that describe the learning process (Olson & Hergenhahn, 2016). Though not universally accepted, an adaptation of Kimble's (1961, cited in Olson & Hergenhahn, 2016) definition of learning has often been used, defining learning as a relatively permanent change in behaviour because of practice (or conditioning). In sport coaching, the theoretical positions on learning associated with behaviourism, cognitivism and constructivism are the most popular (e.g., Cushion et al., 2010) though other ways to group learning theories have also been proposed (Nelson et al., 2016).

Examples of learning theory described from a behaviourist point of view include work by Thorndike and Pavlov in the 1920s and Skinner in the 1950s and focus on the outcomes of stimuli (Groom et al., 2016). Thorndike (1928) proposed that a connection between stimulus and response is strengthened or weakened through trial and error (now known as *instrumental* conditioning). Importantly, Thorndike recognised that the consequences of a response were important in determining the strength of association between the behaviour and outcome, breaking away from the traditional associationistic theories of frequency of occurrence and contiguity that were popular at that time. Furthermore, Pavlov's (1927) theory of *classical* conditioning proposes that the magnitude of learned response is subject to the degree of reward presented with the stimulus, whilst Skinner's (1951) *operant*

conditioning describes how a successful response (i.e., desired behaviour or outcome) is rewarded.

For Skinner, learning takes place under three central conditions, namely the occasion, the behaviour and the consequences of the behaviour, and therefore implies that the role of the instructor/coach in education is that of positively reinforcing behaviours that achieve the desired (i.e., 'correct') outcome. This reinforcement may take the form of a specific (i.e., to the individual) reinforcer, though crucially the athlete (or coach, in a coach education setting) must understand *why* the reinforcement is given (Smith, 2015). Skinner's approach is often referred to as radical behaviourism, with Rogers (1974, cited on Groom et al., 2016) amongst the many critics, arguing that differences between behaviourism and humanism are a philosophical position rather than unique in their approach to fostering an effective learning environment.

In these behaviourist approaches, learning takes place in an incremental (step-by-step) fashion. Tasks and activities are repeatedly practiced to perfect the desired outcome, with positive reinforcement and feedback used to stimulate motivation. Importantly, these approaches also imply that learning can be measured and that cognitive processes are not necessary. Most criticisms of behaviourist approaches centre on the debate surrounding reinforcement (whether through rewards or other means) and the ideographic approaches to research adopted by Skinner (making it difficult to refute his theories, whilst also negating the ability to prove them; Olson & Hergenhahn, 2016).

Cognitive theorists, such as Gestalt, Piaget, Tolman, Gagné and Bandura (though Bandura is not strictly a cognitivist) describe learning from the perspective of changes

to internal structures of the brain. For example, Gagné (1970) argues that learning is hierarchical and progressive in nature, and therefore that simple conditioning provides the foundation upon which more advanced learning can take place. Piaget (1970) elaborates by describing how educational experiences must centre on the learner's own cognitive structures, with optimal learning taking place when a combination of partially known (assimilation) and unknown (accommodation) learning materials are presented in an individualised manner across the developmental lifespan (e.g., Toner et al., 2016). Furthermore, Piaget advocates for learning to take place through discovery rather than instruction (a common feature of constructivist approaches to coaching and coach education), suggesting that external reinforcement may be detrimental to learning and understanding, though this has been recently challenged in American elementary science education where direct instruction has been shown to be a superior method in some instances (Klahr & Nigam, 2004). Calls for modernising approaches to sport coach education by Cushion (e.g., Cushion et al., 2010; Lyle & Cushion, 2012; Cushion et al., 2021) and Nash (e.g., Nash & Collins, 2006; Nash et al., 2012) align well with many of Piaget's observations on optimal learning environments, though these are taken through the lens that much of Piaget's work would be considered cognitive constructivism (e.g., Toner et al., 2016).

Finally, Bandura's social cognitive theory proposes that learning can take place through observation (considered different to the act of imitation in Bandura's theory) as well as symbolic and vicarious experiences. Importantly, Bandura (1977; also, Thomas et al., 2016) observed that behaviour was self-regulated and, as such,

performance standards (and not rewards) provided the barometer by which learning could best be measured. Of primary concern when evaluating cognitive theories of learning is the lack of explanation for the effect of practice domain on the learner, referred to by Bandura as the principle of reciprocal determinism (e.g., Phillips & Orton, 1983); that is, the environment causes changes to both the person and the behaviour, so it is difficult (if not impossible) to establish *cause* of learning in any circumstances. Reciprocal determinism also indicates that learning is the result of a complex interaction between the participants internal state (i.e., their values and beliefs) and their external environment (Thomas et al., 2016). From a coach education perspective, Bandura's theories would describe how the coach/instructor employs strategies to hold the attention of the participants, places great emphasis on observational learning (of the coach/instructor, other participants etc.) and the modelling of correct behaviours in the retention phase, followed by reproduction of these behaviours to reinforce them. In the context of this thesis, Bandura would propose that coaches will learn by observing, interacting with, and mirroring the behaviours of other coaches (Bandura, 1977).

In their review of coach learning and development, Cushion et al. (2010) describe constructivism as a range of approaches to learning that share a common philosophical explanation. Specifically, these approaches and theories describe learning as an interconnected process that stems from the interaction between the learner (including their values, beliefs, and experiences) and their environment, and the resulting meaning that they derive from it. Examples include interpretations of Piaget's theories and Vygotsky (e.g., Potrac et al., 2016). In contrast to theories of

learning situated in the cognitive paradigm, constructivist theorists such as Vygotsky (1932, cited in Potrac et al., 2016) suggest that learning results from social interactions and relationships, rather than based on conditioning or hereditary factors. As such, Vygotsky emphasises the importance of mediation (or facilitation) by parents, teachers, coaches and instructors in the learning journey. In addition, this perspective would suggest that learning was a shared and negotiated experience. Using open questions, providing demonstrations, and introducing the initial elements of a task are all methods adopted by a coach/instructor employing this approach to learning (Moll, 2014).

In concluding, citing work from Tusting and Barton (2006) and Schunk (2009), Cushion et al.'s (2010, pg. 8) review of the coach learning literature infers the following about sports coaches' learning:

1. Learners build on their existing knowledge and experience.

2. Learning is initiated by the learner and a role of the educator is to provide an appropriate environment for learning to occur.

3. Learners have the ability to, and should, learn about how they learn.

4. Learning occurs through engaging in practice and this needs to be supported.

5. Learners need to reflect meaningfully and build on their experiences.

6. Much learning is idiosyncratic and incidental; and cannot be

planned in advance. The environment can be shaped to encourage

experiential learning.

7. Learning should enable the learner to reorganise experience and

see things in new ways, thus having a „transformative" outcome.

The recent evaluation of UKCC by Twitchen and Oakley (2019), and proposals for change to coach development to better reflect the need for coach autonomy in self-determination of additional learning, stem from constructivist approaches where interaction, scaffolded learning through a structured (and facilitated) environment and engaging in social practices enhance the learning process. Though debate is ongoing about the merits of different approaches to understanding learning, particularly surrounding learning as a cognitive process versus theoretical accounts of learning as being more situational, the origins of these different theoretical accounts do offer a glimpse into the complexities of knowledge and learning when trying to develop methods to consistently develop competence in an environment such as sports coaching and other such vocational fields.

A growing body of literature directly examines the influence of different learning paradigms on the design, facilitation and engagement of learning in the context of sport coaching. Much of this work stems from the observed discourse surrounding challenging assumptions about the quality of formal coach training and education (Paquette & Trudel, 2018b) and the need to reconceptualise coach learning to facilitate better understanding and application in real-world settings (Twitchen & Oakley, 2019). In doing so, most of those challenging this status quo accept the need

for reform and to foster deeper learning and engagement through use of more learner-centred, constructivist approaches to coach training and education. For example, Ciampolini et al. (2014), in their review of sports coaches' perceptions of teaching strategies used in large-scale and university-based coach development, revealed that coaches held learner-centred situations and experiences in high regard. Coaches preferred opportunities to take part in facilitated discussions and reflective activities when compared to more didactic, lecture-style learning. Contextualising learning through the sharing of experiences, mistakes and problems were also well-received. Though Ciampolini et al. (2014) recognised the limitations of their approach, which was to adopt a constructivist approach in reviewing the evidence regardless of the approach taken by the primary research authors, they did feel confident that their findings corroborated a required cultural shift toward learner-centred sport coach training and education.

When elaborating on this shift, Paquette and Trudel (2018b) recognise the importance of the Coach Developer (i.e., the instructor/teacher responsible for the delivery of coach training) in achieving higher levels of impactful, contextualised learning within their cohorts of coaches. Specifically, they recognise the value of Coach Developer's competence in a variety of different learning strategies in achieving specified learning outcomes, greater facilitation skills, and a change in the role and power dynamics of coach training and education, from the Developer being in possession of the power to a more autonomous and empowered coach seeking out learning opportunities. This is further supported by Stodter and Cushion (2019a),

who describe perceived confusion by Coach Developers when discussing their understanding and application of learner-centred theories in their practice.

A popular theory used to describe adult learning, and drawing on principles of constructivism, is that of andragogy. Based on a set of principles and core assumptions that describe the learning environment and the learning process, andragogy was popularised by Knowles who defined andragogy as 'the art and science of helping adults learn (Knowles, 1980, p.43). This doctrine suggests that the possession of life and work experiences mediate learning and that learners are self-motivated and self-directed in their pursuit of knowledge (Taylor & Kroth, 2009). Importantly, the theory also assumes that the instructor is a facilitator, that learning is co-constructed and takes the form of activities and exercises that centre of the solving of problems, and real-world scenarios are the organising structure for the learning process (Knowles et al., 2005). In andragogical theory, five important considerations are made when describing the role of the learner in the learning experience. Firstly, the learner's 'concept of self' motivates them to be responsible for their learning. Secondly, if a connection is made between the learners' previous experiences and new learning materials, a greater chance of acceptance of current ideas will present itself (a barrier referred to by Stoszkowski and Collins, 2012, as 'cognitive conservatism'). The third consideration relates to experiential learning, and that problem-solving (and with it, failure and success) will facilitate greater learning opportunities. The fourth and fifth considerations describe the learners' readiness to learn and motivation to learn respectively.

Though andragogical principles are well supported in the education and training literature, certain concerns should be highlighted with regards to their misapplication to sport coach training in the UK. Of immediate concern is that these principles imply a certain amount of individualisation and self-direction is required for effective learning to take place, in contrast to the prescriptive and constrained approach taken by NGBs on coach certification course such as the UKCC. In addition, the principles suggest that life experience can replace more formal education in adult learners. Though not disputing the importance of experience in a sport coaching setting, Kaur (2014) suggests that some sort of instruction and framework for learning is still necessary, to allow the instructor to create the optimum learning environment for candidates on sport coaching courses. So, whilst principles of constructivism and active learner-centred approaches to coach development are recommended, it is less clear whether principles of andragogy in their truest sense can be as easily applied in a coach training setting.

Expertise in Sport Coaching

Problematic in understanding the features of an expert sports coach is the variety of different themes investigated by researchers, and a subsequent lack of continuity in theoretical approaches and practical applications (Wharton & Rossi, 2015). Though a larger number of studies have been conducted into the journey that coaches take in developing their expertise, other themes include differences between novice and expert decision-making, cognitive processes, and visual search strategies. This led Nash et al. (2012) to question whether expertise has been investigated sufficiently to draw appropriate conclusions as to the cognitive, technical and pedagogical makeup

of an expert coach, as well as challenging whether research was examining expertise or merely the practices of elite sports coaches (see also Wharton & Rossi, 2015).

Much of the research on coaching expertise stems from that conducted into the helping professions (e.g., psychotherapy, counselling) and healthcare (e.g., nursing, physiotherapy etc.) from a cognitive perspective, and centres on the deliberate practice literature (e.g., Ericsson & Charness, 1994). Deliberate practice is a specialised type designed to improve performance through a repetitive, feedback-focused type of practice that is both purposeful and systematic. As well as being the focus of significant media attention in popular sporting literature, including books such as 'Bounce' (Syed, 2011) and 'Perfection Point' (Brenkus, 2011), deliberate practice theories have been put forward to explain expertise in a number of professional domains, including music, sport and education (e.g., Ericsson & Lehmann, 1996). For example, the '10000-hour' rule that suggests the minimum accumulation of (deliberate) practice to be successful at the highest levels emanates from this theory and has been the cornerstone of several explanations of sport skill proficiency, and often used in research to define sport coaching expertise (e.g., Schempp et al., 2006). Indeed, of the fifty papers reviewed by Nash et al. (2012) in their review of the sport coaching expertise literature, twenty-seven of them used some derivation of this rule as a criterion for participant selection and inclusion (though one thousand hours is used as the threshold to describe expertise in sport coaching; Ericsson et al., 1993). It is worth noting that, whilst deliberate practice is a popular and often cited theoretical account of expertise, there is limited evidence to suggest that individual differences in sporting performance could be accounted for

by deliberate practice alone, with as little as 18% of the variance in performance attributed to deliberate practice in a recent meta-analysis by Macnamara et al. (2016). It could be safely assumed that the same would apply to other domains of expertise in sport, including coaching.

Berry (2020) provides an insightful discussion surrounding the complexity surrounding defining expertise in coaching, observing the dichotomous nature of viewing coaching as a process (e.g., Farrington-Darby & Wilson, 2006) or outcome (e.g., Ericsson & Charness, 1994). Specifically, an outcome conceptualisation would view expertise as being a masterful performance that is reproducible, a consequence of deliberate practice (or *routine* expertise), and analogous to the frameworks employed by NGBs of sport to determine competency through the UKCC framework, particularly at Levels 1 and 2 where (in the authors opinion) the benchmark for coaching performance is low and designed to facilitate growth in volume of sport coaches rather than quality. In contrast, a definition focused on process would imply that an expert is someone that can master novel tasks and apply them to novel settings, referred to by Berry (2020, citing Hytönen, 2016) as *adaptive* expertise. Importantly, adaptive expertise would allow the sports coach to be agile in managing the challenging and dynamic environments that they face.

What differentiates adaptive sport coaching experts from their routine expert counterparts is the ability to assimilate and understand domain specific knowledge and skills and apply them in creative, flexible and innovative ways, as opposed to a more procedural and process-driven approach whereby the coach would deploy a more recipe-like approach to their coaching (Mees et al*.,* 2020). A possible

implication of this might be that a less prescriptive approach to learning would be of greater benefit to adaptive experts, whilst also influencing how a coach might retain, make sense of, and articulate their knowledge (Mees et al., 2020). Common aspects of all theoretical accounts of adaptive expertise include elevated levels of situational awareness, possession of specialised technical and pedagogic skills, and sufficient self-awareness to balance demands of the individual with their abilities (Hutton et al., 2017, cited in Mees et al., 2020; see Table 2). In the context of this thesis, an adaptive expert would be a sports coach that can apply sport science knowledge to their day-to-day practice to enhance or maintain training levels and competitive performance (Schempp et al., 2006). It could be inferred that this type of expertise should describe all coaches in possession of a UKCC Level 3 qualification and/or been nominated by NGBs for UKCC Level 4. As such, it offers a tenuous rationale as to why UKCC Levels 1 and 2 are focused on declarative knowledge delivered in a predominantly prescriptive fashion.

Table 2: Examples of adaptive expertise employed by sport coaches (adapted from Mees et al., 2020, pg. 426)

Dimension	Experience example and research support
Solving problems creatively	Having to solve problems for which there are no easy or straightforward solutions
Dealing with uncertain or unpredictable situations	Operating with incomplete information regarding a situation
Learning new tasks, technologies, and procedures	The synergy and dynamic nature of task, environment, and the individual generate unique challenges that require the development of novel solutions
Demonstrating interpersonal adaptability	Contending with the 'needs versus wants' balance with participants and their parents/other coaches etc.
Demonstrating cultural adaptability	Learning the rules for appropriate interaction in different training and competition environments
Demonstrating physically orientated adaptability	Instructors participating/demonstrating as part of the coaching process
Managing work stress	Roles and responsibilities of the coach are multi-functional
Handling emergencies or crisis situations	Making quick decisions in difficult circumstances

Schempp et al. (2006) suggest that an important distinction exists when discussing expertise in sport coaching, namely that expert coaches are those able to consistently produce outstanding performances in a greater variety of environments and in a shorter space of time when compared to coaches with less expertise. A feature of this expertise is that coaches invest in learning all they can about their subject, through undertaking Continued Professional Development (CPD) and through engagement with a variety of knowledge sources (Schempp et al., 2007). Importantly, experts can be characterised as those able to use this underlying knowledge to solve problems in-situ, though this knowledge is both individualised and situational since it has been observed that differences exist between expert coaches on what constitutes fundamental knowledge in their sport (e.g., Grant et al., 2012).

Professional Development

One of the greatest advantages of professional regulation, and with it some sort of chartered, accredited or licensed status, is the protection it affords participants and the quality assurance that accompanies it (e.g., Potrac et al., 2012). Though the construct of knowledge has been previously discussed in this thesis, much of the literature surrounding professional development discusses the relationship between *knowing* and *doing*, with four different philosophical positions generally agreed (West, 2016). The first position describes how *knowing* is taught, but that *doing* only happens in the workplace. Secondly, though there may be several types of *knowing* and *doing*, they are still *knowing* and *doing*. The third position recognises the relationship between *knowing* and *doing* and identifies the movement between an educational and workplace context. Finally, the fourth position describes the

relationship between theoretical, practical, explicit, and tacit knowledge used in the learning process.

Competency-based frameworks, such as the UK Coaching Certificate, fall under the umbrella of the first philosophical position where it is implied that declarative knowledge (*knowing*), mainly acquired from training and education, precedes procedural knowledge (*doing*). Eraut (2009) suggests that a clear understanding is required of an individuals' knowledge base in order for this position to be tenable, and that this approach (of separating declarative and procedural knowledge) largely overlooks the problem of making knowledge accessible to the professional in their workplace setting. West (2016) describes how this approach is used in accountancy, where a similar competency-based framework is used as in sport coaching (though the educational requirements of accountancy are significantly higher at entry-level than they are for sport coaching). Continuing this theme, Schon (1987) argues that procedural knowledge must be assessed as part of a competency-based framework to prepare trainee teachers for real-world problem solving.

The second philosophical position is posited on the view that there are several types of *knowing* and *doing*, but that both are applied to educational and workplace settings. Using engineering as a case-study, Shay (2013) argues the case for curriculum differentiation, suggesting that there is a theoretical and practical curriculum required to be a successful professional. This is in contrast to the work of Schon (1987) and Eraut (2009), who propose a clear and unambiguous demarcation of the roles of education (i.e., sport coach training and education) and the workplace (i.e., the training field, track, rink or court). Importantly, Shay (2013) observes the

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need for contextualisation of knowledge in the workplace setting, a theme that resonates with the criticisms of the literature evaluating the effectiveness of current sport coach training (e.g., Cushion et al., 2010; Twitchen & Oakley, 2019). Furthermore, West (2016) describes underlying tension that exists between educational and workplace settings, particularly when newly qualified professionals (whether that be accountants, engineers, teachers or sports coaches) struggle to relate declarative concepts to procedural situations.

The third position is primarily based on Howell's (1982) work on conscious competence and describes the four stages of professional development in both education and workplace contexts from being unconsciously incompetent (not knowing what you don't know) to unconscious competence (using knowledge in a skilful and intuitive way). More recent elaboration on this approach has added a fifth stage of reflective competency, enabling the learner to articulate their decisions and understand how and why they employed certain knowledge, techniques, and skills in any given situation (Johns, 2009), and making this model of professional development more cyclical in nature (cf. Gibbs, 1998; Kolb, 1984). This philosophical position highlights the importance of both education and workplace learning on expertise, and that both theoretical and practical knowledge and skills can be developed in both settings. A shift toward more in-situ assessment of sport coaching practice, previously discussed, lends itself to this position as does approaches to maintaining professional standards in healthcare occupations such as physiotherapy (HCPC, 2022).

The fourth and final philosophical and theoretical standpoint relates to separate ways that knowledge types can be combined and translated. This builds on the work of Dreyfus and Dreyfus (2004), who argue that knowledge is determined by context, and that over time professionals will use explicit and tacit knowledge in unusual ways. Importantly, experiential learning will mediate this relationship (Dreyfus & Dreyfus, 2004) and, in doing so, places additional value on the role of the educator/developer to facilitate the conversion and/or combination of tacit and explicit knowledge. Of particular interest in this thesis is how this position was derived from the work of Polanyi (1966, cited in Dreyfus & Dreyfus, 2004) in establishing the Socialisation, Externalisation, Combination and Internalisation (SECI) model of knowledge creation and transfer (Nonaka & Takeuchi, 1996; Figure 2).

Externalisation refers to the complex process of converting tacit knowledge to explicit knowledge, with metaphors suggested as a possible mechanism to support the conversion, whilst *internalisation* refers to the opposing process of translating episodic and declarative knowledge from curricula to something personalised to the individual in the form of tacit knowledge (Nonaka & Takeuchi, 1996). *Combination* describes the simplest transfer of knowledge where explicit knowledge is transferred from one source to another, and *socialisation* refers to the mechanism by which tacit knowledge is shared between individuals. The largest flaw in the SECI model assumes that all tacit knowledge can be transferred and/or translated, especially given the difficulties that individuals have in articulating tacit knowledge (e.g., Werthner & Trudel, 2006; Nash & Collins, 2006). This in itself has been argued to be a misinterpretation of Polanyi's original work but does offer a practical insight into the

challenges associated with professional development, particularly the role of education and principles of lifelong learning in developing expertise.

Socialisation

Internalisation

Tacit

Tacit

Explicit

Explicit

Externalisation

Combination
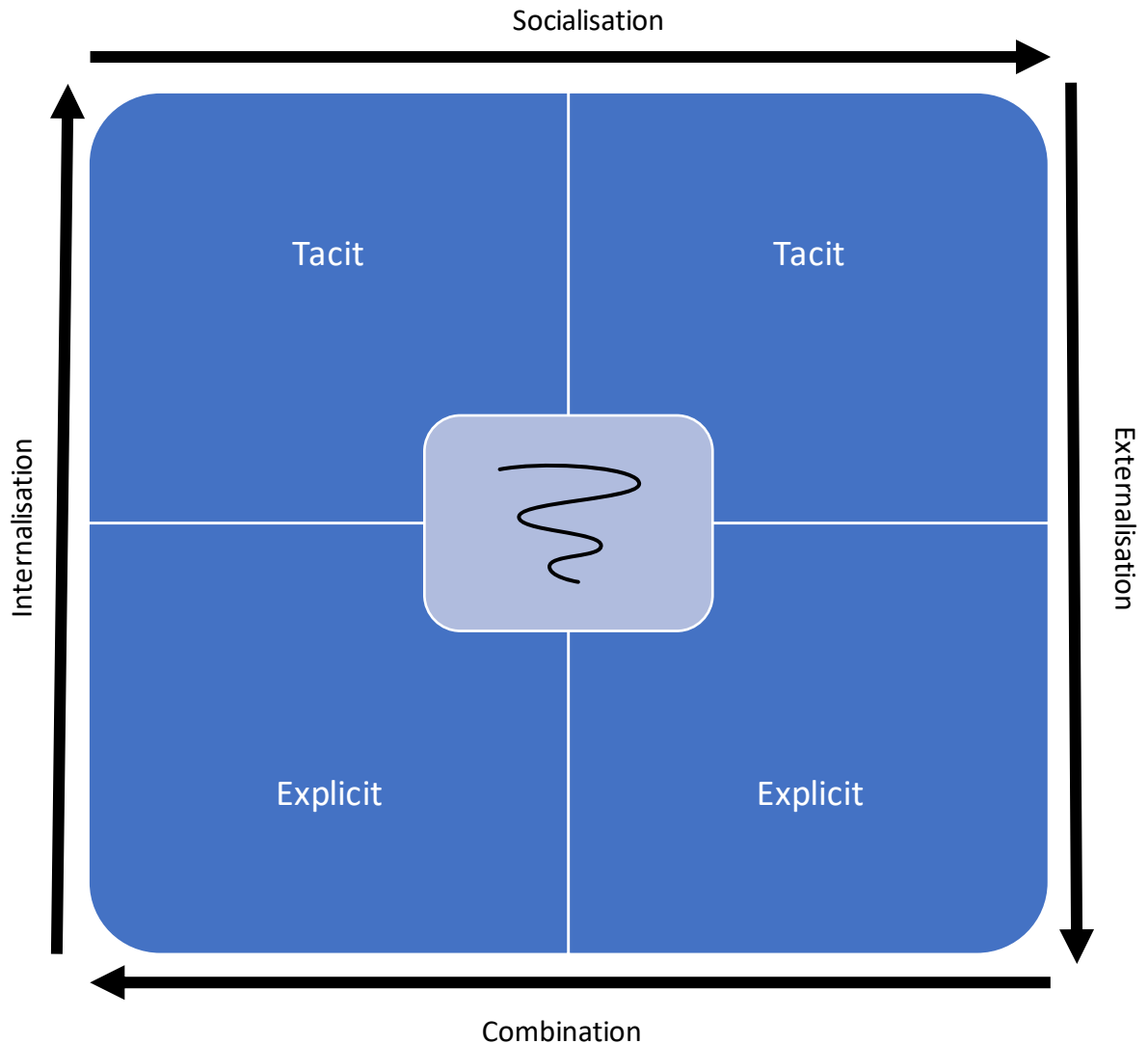
Figure 2: The SECI Model (adapted from West, 2016)

A well-established model of professional skill acquisition developed by Dreyfus (e.g., Dreyfus & Dreyfus, 2004) describes the journey from novice to expert as a lifelong learning process, based on situated performance and experiential learning. Dreyfus describes five discrete stages of learning and development, namely *novice*, *advanced beginner*, *competent*, *proficient*, and *expert*, and reflects movement from abstract

theories (i.e., declarative knowledge) to the mediation of this knowledge in practical environments based on past experiences. Applying this to sport coaching, the model implies that, in the initial stages of professional development, *novice* coaches will acquire knowledge without contextual meaning and that they would be unable to determine which knowledge and skills might be relevant in a real situation (West, 2016). As coaches gain experience, often through the facilitation of an instructor (coach developer), they begin to see patterns in recurring practical experiences. As such, the *advanced beginner* will need guidance and support in recognising aspects of situations and examples.

Dreyfus and Dreyfus (2004) suggest that two to three years of working in the field allows professionals to foster meaningful relationships between their actions and the outcome, providing perspective and reinforcing emergent tacit knowledge themes. Furthermore, this level of *competent* professional may be sufficient for most employers resulting in a lack of encouragement to pursue higher levels of expertise (Dreyfus and Dreyfus, 2004). A criticism placed on this model is that it is unclear in Dreyfus's work why some individuals reach higher levels of expertise than others (e.g., West, 2016). Many professional bodies function as gatekeepers to the CPD and knowledge on offer to their members and it is often both costly and time-intensive to explore professional development outside of mainstream governing body offerings. As such, it could be argued that these bodies do not want to relinquish control over the knowledge and skill development available, preventing achievement of higher levels of expertise as a result (Twitchen and Oakley, 2019).

An alternative explanation for observed ceilings in expertise is made by Kuhlmann and Ardichvili (2015) in their study exploring the development of expertise in tax accountants, who propose that over time (competent) non-experts will focus on developing routines for regular problems encountered as part of day-to-day practice and, as reliance on these routines increase, the opportunity to continue to develop is diminished. They further suggest that it is the phenomenon known as progressive problem solving (Bereiter & Scardmalia, 1993) that facilitates future continued professional development, suggesting that the nature and complexity of problems encountered on a day-to-day basis leads the competent professional to proficient or expert status as they develop.

At the *proficient* level, professionals are able to learn through experiential means, resulting in the development of contextualised principles by which they can apply their knowledge in novel situations. Applying to the sport coaching context, this would suggest that higher levels of coach training and education demand facilitation and context else run the risk of coaches feeling frustrated and disconnected from the curriculum, supporting the distinction made between routine and adaptive experts by Schempp et al. (2006). The final stage of Dreyfus and Dreyfus's (2004) model describes the *expert* as a practitioner that relies on tacit knowledge to prioritise and manage complex problems amidst uncertainty. Paradoxically, and as previously discussed, experts will often struggle to articulate the rationale behind their decisions and/or offer plausible explanations for how/why they acted in certain ways making ways to design appropriate training and education particularly challenging, not to mention the training of instructors to deliver such programmes (Elvira et al., 2017).

Significantly, the work of Dreyfus and Dreyfus (2004) also proposes that professionals possess distinct levels of skill in different areas based on their education and professional experience. A large-scale piece of research examining expertise found that nurses simultaneously displayed characteristics of a number of Dreyfus's stages of professional development, leading the researcher to suggest that expertise in nursing develops as a result experiential learning and practice over a period of time (Benner, 2004). In doing this, Benner (2004) accepts that newly qualified graduate nurses are not fully qualified professionals. This somewhat contradicts the stepwise progression that is suggested in other parts of the step-change models discussed earlier in this review, though is difficult to establish without longitudinal studies of professional development or clearly defined reference points of expertise (e.g., Dall'Alba & Sandberg, 2006).

In summarising the literature reviewed pertaining to both expertise and professional development, the parallels and differences between sport coaching training and education and other professions such as accountancy, engineering, law, nursing and teaching are evident in the challenges faced in establishing the roles of educational and workplace environments in learning, and limited explanation as to how individuals transition from one stage to the next of the expertise models presented here. What is clear is that training and development needs cannot be met without the involvement of theoretical, practical and situational knowledge, as well as facilitation by highly qualified instructors, coach developers, coach mentors or other coaches in a socially constructed learning environment (Wallin et al., 2019). One of the challenges faced in sport coaching that is unique to the profession is the uncertain

role of further and higher education provision in the development of coaches. Whereas all the other professions discussed here have mandatory educational requirements associated with professional recognition, there is currently no such legislation in place for sport coaching.

Sources of Coaching Knowledge

Much of the research on sport coaching to-date has focused on *how* coaches learn, by either examining sources of knowledge or the life history of coaches, with eight sources of knowledge being identified within this review, namely formal education, workshops, experience, interactions with other coaches and athletes, observation, resource materials, mentoring and reflection. What is less clear, however, is an understanding of how these sources interact with contextual factors, such as the coaches' own circumstances and the learning context (e.g., Deek et al., 2013; Watts & Cushion, 2017; Stodter & Cushion, 2019; Cope et al., 2021), in what Webb and Leeder (2021) describe as a 'somewhat sobering picture' (pg. 2).

Two popular methods of classifying learning exist within the sport coaching literature (Werthner and Trudel, 2006; Cushion *et al.*, 2010). Werthner and Trudel (2006) describe how cognitive structure change under the influence of different learning contexts, namely mediated, unmediated and internal. Similarly, Nelson et al. (2006) and Cushion et al. (2010) describe learning as being formal, non-formal or informal using Coombs and Ahmed's (1974, cited in Colley et al*.,* 2003) conceptual framework of learning. Mediated learning occurs when the learner (the coach) is directed to the most paramount information by a more experienced peer, usually another coach (though a sport scientist in the context of this thesis would also seem appropriate).

This can often take the form of mentoring and other forms of facilitated learning experiences such as communities of practice (Bloom et al., 1998; Lyle, 2002). Whilst there are similarities between mediated and formal learning, a key to understanding the difference is the purpose of a standardised curriculum in developing knowledge. Nelson et al. (2006) suggests that coaches undertaking such curricula are formal learning situations, implying that other *facilitated* learning opportunities such as mentoring, fall outside this definition. National Governing Body (NGB) coaching qualifications provide an insight into this type of learning, and usually require that participants demonstrate their understanding (and often competency) to receive certification. The United Kingdom Coaching Certificate (UKCC) is the largest and most obvious example of this type of formal learning in this context.

Some flaws in existing NGB coach training practises exist, with Cushion et al. (2010) describing formal learning experiences on a continuum of effectiveness between education and indoctrination. Amongst the notable criticisms placed on this type of coach training is it infers that coaching becomes a recipe or process that can be transferred for recipients to replicate to their participants. Furthermore, it suggests that this model of coaching is curriculum-driven (rather than coach- or participant-driven) whereby the behaviours of 'expert' coaches are modelled for others to follow (Abraham & Collins, 1998; Potrac et al., 2002; Dray et al., 2016). A more recent evaluation of coach learning and training by Twitchen and Oakley (2019) substantiates these observations, notably that evaluation of formal coach training (i.e., regulated coaching qualifications) and the measurable impact on successful practice is scarce. It is worth noting that no distinction is made between entry-level

qualifications (i.e., Levels 1 and 2 of the UKCC) and qualifications designed for more experienced coaches (i.e., Levels 3 and 4) within the growing of work critiquing coach training in the UK.

In an interview-based study similar in size to the population for the first study in this thesis, Piggott (2012) explored the nature of coaches' experiences of formal coach education using Popper's (1972) critical rationalism approach to investigate 'closed circles' in coach education, and to establish why coach education courses were not considered useful. A closed circle is an irrational social construct where actors (participants) are not exposed to ideas, concepts or knowledge outside their own social group (in this case, the NGB or sport). Key principles underlying closed circles are that core knowledge, that by which practice and understanding are governed within a community, is not questioned by members of the group, nor is criticism accepted from outside this membership. When suggesting that National Governing Body's '...could be styled as closed circles with a central dogma represented, in this case, by a coaching manual (or curriculum)' (pg. 539), Piggott (2012) further suggests that stakeholders in formal coach education may be contesting attempted changes to professionalise and homogenise coaching owing to these proposed closed circles. On analysing his findings, Piggott (2012) revealed that not all coaches perceived their NGBs coach training to be closed circle, contrary to the research hypothesis, although larger NGBs (in terms of number of active coaches and investment, Football, Athletics, Cricket, Swimming) were perceived to be closed. The types of phrases used to describe these courses included 'by the book', 'formulaic' and 'accepted without discussion'. Although only a small number were identified, coach education courses

that encouraged openness were found to be more useful to the participants that undertook them (in Volleyball and Orienteering), being described by Piggott (2012) as endorsing a more liberal philosophy and extoling the benefits of a constructivist approach to learning that is more closely aligned to the larger-scale operational definition of mediated learning used by Werthner and Trudel (2006).

Unmediated and non-formal learning describe how coaches identify the types of knowledge and information that they need, and then strategising how to go about sourcing this information using their own initiative. An example provided in Erickson et al. (2008) is that of observing other coaches, referred to by Sage (1989) as informal apprenticeship and described by Vosniadou and Kollias (2003) as a social as well as cognitive process. Similarly, interaction with colleagues and peers in organised educational activities in isolation from formal education is also offered as an example of this type of learning (e.g., Colley et al., 2003). These types of activities offer specialised types of learning for personnel with unique needs (for example, high-performance sport coaches or coaches of athletes with mental or physical disabilities), and often come in the form of face-to-face or web-based conferences, clinics, or webinars. Continued Professional Development (CPD) opportunities can often take this form, where coaches self-select identifiable areas for development, enhancement or to update existing knowledge.

CPD is a term coined to describe the notion of lifelong learning within a profession, through the broadening of knowledge and skills key to success within that profession (e.g., Friedman and Phillips, 2001). Though not an exhaustive list, CPD may involve activities such as lectures, workshops, conferences, and in-situ coaching observation,

amongst others. The suggested benefits of CPD programmes include improved retention and raised professional standards within a profession, however compulsory CPD has not necessarily been shown to improve competence in all professions (e.g., Nursing, French and Dowds, 2008) and research is inconclusive as to the effectiveness of CPD on participant learning with regards to the transformative effects on outcome (Neimeyer et al., 2012). This type of learning is of particular interest in this thesis, since anecdotally appetite for solving certain athlete-centred problems is often a coaches' motivation to either employ other experts such as sport scientists or delve deeper into the topics of sport science for answers. It is also a feature of adaptive expertise, since adaptive experts will source knowledge to solve unique, situation-specific problems (Mees et al., 2020).

In the UK, a number of professions have ongoing programmes of CPD to satisfy professional regulatory requirements. For example, accountancy, nursing and law all require specific amounts of regular (normally on an annual basis) CPD provision to maintain licensed (chartered or accredited) status (e.g., Karas et al., 2020). In many cases, this CPD takes the form of courses delivering prescribed (and often mandatory) content whilst other organisations encourage individuals to self-determine their CPD needs. For example, to satisfy the ongoing requirements of the Register of Exercise Professionals (REPS, the regulatory body for the fitness industry), gym instructors and other fitness professionals must accumulate a certain number of CPD points within a set time period to maintain their professional status (CIMSPA, 2022).

Despite the importance and value of CPD in other professions, the perception that sport coaching is 'not a profession' is suggested as being integral to the limited take-

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up of CPD opportunities by coaches (Nash et al., 2017). In exploring sports coaches' views and understanding of CPD, Nash et al. (2017) identified three emergent themes from interviews conducted with twenty-five sports coaches in the UK, namely the value placed on CPD, coach development, and input from the National Governing Body. Several of the coaches interviewed for the study were unable to articulate their own developmental needs and, as such, were not able to meaningfully suggest CPD activities. In many instances, where a greater understanding was prevalent, participants did not recognise the importance of further CPD after certification, citing its limited value to their development as coaches and the low priority placed on CPD by NGBs as being key to this reticence.

Nash et al. (2017) discuss the challenges faced by the (mostly) voluntary sport coaching workforce in the UK, citing the complexity of introducing individualised CPD programmes offset against the cost (both financial and time) that this would necessitate. In concluding, they recommend a CPD model that evolves from being prescriptive in the formative stages to a more flexible and individualised approach with more experienced coaches (see Table 3). This approach supports the notion of adaptive expertise, in that adaptive experts (described as elite coaches in Table 3) are more able to self-determine learning opportunities and reflect on past experiences. It could be inferred that this approach to CPD would also provide the optimal learning environment to shift sports coaches from competent to proficient/expert in Dreyfus's five-stage model of professional development (Dreyfus and Dreyfus, 2004).

Unmediated and non-formal learning requires that the coach possesses the knowledge and skills to access and make effective use of learning opportunities

afforded to them. This type of learning is recognised elsewhere as being fundamental to a culture shift in how coach education is viewed, where efforts in New Zealand to shift away from more traditional programmes of coach education toward an athlete-centred approach to coach development have been observed (Cassidy and Kidman, 2010). Though not intended, the definition and description of unmediated and non-formal learning situations presented here infer a start and finish to learning and training, rather than as a more continuous and life-long endeavour (Cushion et al., 2003). Crucially, mediated/formal and unmediated/non-formal education infer that the instructor/provider possesses the knowledge, implying that knowledge is transmitted from instructor to learner and that this will impact on outcome as measured by changes in behaviour or action if not facilitated correctly.

The final category in Nelson et al.'s (2006) description of learning environments is informal activities, best described as the lifelong process that takes place as a result of personal experience and activity within (and exposure to) the environment and is often viewed as the dominant form of learning undertaken by sport coaches, though this maybe as a result of other learning methods being ineffective and inadequate in satisfying coaches' learning needs (Cushion et al., 2010). One of the challenges in describing informal learning is that informal and non-formal learning are often used interchangeably (e.g., Colley et al., 2003). Examples of informal learning include participating in the activity (e.g., Irwin et al., 2004; Blackett et al., 2017), learning from previous coaches and/or own coaching experiences (e.g., Abraham et al., 2006), and mentoring (e.g., Cushion et al., 2001), as well as the unintended learning that takes place as a result of attendance at formal coach training during breaks between

sessions and study blocks, when participants share practice, ideas and experiences. Other sources of informal learning also include the internet, coaching manuals, written materials such as books and research journals, social media, and video footage of other coaches and coaches' own performances (Cushion et al., 2010).

Systems to recognise and accredit informal learning as part of coach education are currently not in place and require further development, though this is a recognised problem across the professionalisation literature (Dray et al., 2016). Notwithstanding these other professions, such as those affiliated with the Health and Care Professional Council (HCPC), recognise a large number of different activities (including work-based learning and self-directed activities, such as reading and use of a log to record progress) in their professional standards (HCPC, 2022).

The challenge facing coach developers is that informal education is potentially an 'incidental by-product' (Kaur, 2014) of some other activity (Mallett et al., 2009), suggesting that learning does not always occur in situations that can easily be monitored, evaluated and measured for the purposes of ratifying a coaches' competence and/or safety. As such, despite the growing body of evidence that informal education situations are considered more valuable (Cushion et al., 2003), they are by far the least utilised mechanism to stimulate coach development across the UK Coaching Framework.

Table 3: Continued Professional Development (CPD) model (adapted from Nash et al., 2017)

Stages of Coaching

		Aspiring	Novice	Developmental	Elite
Characteristics of coaches	*Purpose of CPD*	Pre-qualification. Little knowledge or experience Inspire/motivate/enthuse	Early stages of coaching. Working with more knowledgeable coaches Build and expand knowledge base	Committed to education and improvement Develop and apply knowledge in context	Working with coaching programmes and leading other coaches Identify and resolve individual needs
	CPD provider	Local sports clubs, Local sports councils	Sporting Organizations, Coaching Organizations, other sports bodies & charitable organizations	Sporting Organizations, Coaching Organizations	Formal links between Sporting organizations and Higher Education Institutions
	Format of CPD	Informal, information-giving and voluntary	Range of formats form formal to informal. Making use of traditional methods as well as web discussions, blogs etc.	Coaching forums: creating the cross fertilization of coaches between sports. Coach observations, discussions and reviews	Problem-based learning; decision-making situations; critical thinking skills
	Benefits of CPD	Encourage participants to undertake formal qualifications	Identify and strengthen coaching commitment. Develop the key skills of both coaching and professional practice	Reflect on, discuss and review coaching practice. Formulate goals to strengthen coaching practice	Develop self-determining, self-regulating coaches. Establish personal and team learning plans

Sport England (2016, 2021) recognise the importance of informal and non-formal learning opportunities in policy by emphasising how coaches will be offered opportunities to receive access to a mentor or coach developer (with an ambitious target of 75% of the coaching workforce having access to one by 2021), digital learning resources (by 2019) and a coaching conference (by 2018) in their plan for coaching, though some of these objectives were curtailed by the COVID-19 pandemic. In doing so, they recognised that a large body of evidence exists to support the contention '...that many coaches obtain qualifications for minimum deployment standards then stop learning and improving' (Sport England, 2016, pg. 22). In suggesting the introduction of such opportunities, the organisation recognised the importance of a blended approach to coach education and development that takes advantage of the benefits of formal and informal learning, rather than being over-reliant on the more traditional, formal methods used to-date.

Werthner and Trudel (1986) describe internal learning as a cognitive process where no added information is presented, but where a '...reconsideration of existing ideas' takes place (p. 201). Tacit knowledge, and the reflexive nature of how this knowledge is applied but not articulated, would seem like an obvious example of this type of knowledge and is also a feature of expertise as outlined by Dreyfus and Dreyfus (2004). Parallels between this type of learning and experiential learning, where learning takes place through individual experience situated in the workplace alongside abstract knowledge creation and formation as a result of these experiences, has been regularly cited as a vital component of learning in many different vocations, including higher education (Heinrich et al., 2021) and life

coaching (McHenry, 2016) as well as for sports coaches on both NGB and University sport coach training and education (Cronin & Lowes, 2016; Stone et al., 2020). A distinction between experiential learning and 'learning through experience' has been made, where structured learning opportunities (experiential learning) come about as a result of close collaboration between the learner and educator (i.e., coach developer or mentor, in this context) to facilitate better understanding of how knowledge can be applied in practice (Cronin & Lowes, 2016). Examples of support for experiential learning also exist in the further and higher education sport coaching context (Cronin and Lowes, 2016) as well as nursing (Benner, 2004).

Exploring the Impact of Coach Education over Time

It should be clear from the literature presented in this thesis so far that sport coaches learn from a variety of different knowledge sources and in different ways, however only a small number of research studies have investigated changes over time in coach knowledge, learning and practice suggesting that a clear understanding of how sources of knowledge interact with other factors in the learning process is limited (Deek et al., 2013). Additionally, Jones and Allison (2014) observe that limited research has investigated the unintended learning that takes place as a result of coach education; learning that is often unplanned, and with some degree of latency, which is not necessarily facilitated by tutors on such courses. Of these, Deek et al. (2013), Jones and Allison (2014), Stodter and Cushion (2017) and Stodter and Cushion (2019b) all explore the impact of formal coach training in coaches already certified to practice (i.e., those in possession of at least a UKCC Level 2 coach certification).

Adopting Trudel et al.'s (2013) description of mediated, unmediated and internal learning situations (also Werthner & Trudel, 2006; Werthner et al., 2012), Deek et al. (2013) explored the impact of a continued professional development (CPD) coach education programme on coach learning from a life-long learning (i.e., constructivist) perspective. Using a case-study approach, Deek et al. (2013) examined the impact on coach learning of three development modules on Canada's National Coaching Certification Program (NCCP) by interviewing a sample of coaches undertaking the modules. Findings indicated that eight of the ten coaches reported changes in their practice in follow-up interviews three months after completing the modules. Deek et al. (2013) subscribes the influence of the instructor to these changes, suggesting that a more collaborative approach to learning was mediated by those delivering this programme of coach development. As such, they suggested that a less didactic approach was employed by the instructors on the modules, favouring a more collaborative approach to this type of CPD.

Exploring similar parameters in a group of high-performance coaches, Jones and Allison (2014) mapped the development of knowledge of those enrolled on an eighteen-month high-performance coach education programme. Significantly, the course in question contained many features of both formal (in terms of competency assessment and classroom-based residential learning and teaching) and informal (in terms of an assigned mentor) learning features. Using a mixed methods approach comprising video diaries and focus group interviews, Jones and Allison (2014) highlighted the importance of informal opportunities for learning in their participants. Importantly, they also acknowledged that much of what *could* be learnt

on such courses was viewed as being irrelevant, broadly supporting the challenges changing the 'default view' (Cushion et al., 2010) of coaches upon entry into coach development. Jones and Allison (2014) also discuss the impact of insecurity in their participants, recognising that uncertainty and lack of job security in sport coaching may make participants seek out immediate 'tips and tricks' to enhance their practice rather than investing time and energy in longer-term, knowledge-based solutions. Criticism of the decontextualised nature of competency assessment and the positive role of mentors was also discussed by the coaches that participated in this study. The authors propose programmes to better prepare high-performance coaches for the complexity surrounding their chosen careers, citing their own work (e.g., Jones et al., 2013) as an example of how coaching might be recontextualised to address some of these concerns.

In recognising the complexities of learning, particularly in sport coaching where translation into changes in practice are often reported as being low if at all, a body of work by Stodter (Stodter, 2014; Stodter & Cushion, 2014; Stodter & Cushion, 2017; Stodter et al., 2019b) has looked to make inroads into establishing a specific learning theory for sport coaching. Employing a longitudinal approach using interviews and stimulated recall, Stodter and Cushion (2017, also Stodter, 2014) examined learning processes in UKCC Level 2 or above-qualified English youth soccer coaches. In their grounded theory of coach learning, Stodter and Cushion (2017) describe a series of filters through which all knowledge passes, suggesting that different outcomes will result from the same learning opportunities with different coaches. Reporting similar observations to those of Jones and Allison (2014), coaches' biographies, combining

their values, beliefs and previous knowledge, function as an individual level filter where new knowledge is partnered with existing knowledge before adoption or rejection (see Figure 3). A further filter, aligning this new knowledge with the context within which coaches are working is then applied, with Stodter and Cushion (2017) using Abraham et al.'s (2006) distinction between the translation of concepts to conceptions as a means to explain how coaches will add meaning to new knowledge in their own workplace context (Figure 3). This will be moderated by a combination of knowledge (context, athletes) and other moderating factors including the environment before any initial attempts to apply new knowledge are initiated.

Further moderation, in the form of the coaches' openness to latest ideas and reflection, will lead to new knowledge being rejected or adapted to the situation. A final reflective feedback loop will determine the extent to which coaches adopt any new knowledge, with continued openness of mind being a key moderating factor in whether coaches continue to adopt the use of new knowledge and learning in their practice (Stodter & Cushion, 2017). As with previous studies reported in this review of literature, the work of Stodter explored broad use of knowledge by sport coaches, rather than with an emphasis on any particular type of knowledge such as sport science, but the relevance of some features of the work are worth highlighting here. Firstly, the findings of this research and subsequent model recognises the moderating features of self in the search for and acquisition of knowledge, a key feature of constructivist theories of learning and andragogical approaches to lifelong learning in particular. Secondly, learning is mediated by a number of personal, organisational and cultural factors, with the authors highlighting how this aspect of their study
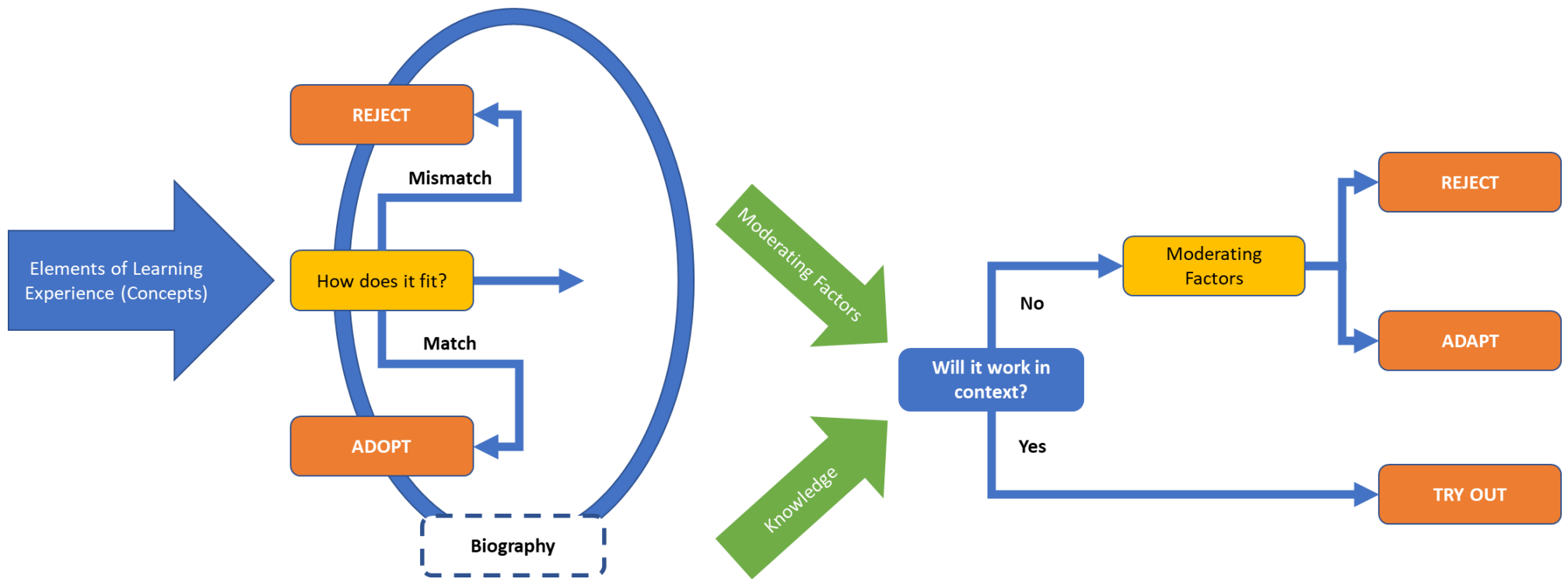
Figure 3: Individual and contextual level processes associated with coach learning (adapted from Stodter and Cushion, 2017)

supports Vygotsky's observations on learning as a socially constructed process. Finally, the findings of Stodter suggest that coach development, whether through NGBs, further and higher education, or through CPD providers, need to take steps to avoid learners' rejecting new knowledge by carefully considering the environment and approaches used to deliver such formal training and education.

Building on their earlier work, Stodter (Stodter & Cushion, 2019b) re-examined her data comparing practice behaviours amongst participants that were engaged with formal learning with those that were not. Using a combination of the Coach Analysis and Intervention System (CAIS; Cushion et al., 2012) and stimulated recall interviews, changes were found in the use of knowledge by those coaches undertaking formal training, including increased use of questioning in sessions (though this was the primary focus of the programme being delivered) and a shift in use of technical to tactical prompts and knowledge (Stodter and Cushion, 2019b). However, only limited changes were seen in practice behaviours suggesting a lack of deep learning and reinforcing some of the criticisms shared previously pertaining to formal coach training. In this example, the authors concluded that the disconnect between knowledge and action was primarily owing to the 'low impact' nature of coach training as an agent of meaningful change in practice.

In contrast to the studies discussed above, who conducted studies with sports coaches with previous experience, Webb and Leeder (2021) sought to better understand the impact of an entry level sport-specific coaching course on novice coaches' disposition and learning. Drawing on Hodkinson and colleagues' (e.g., Hager & Hodkinson, 2009) interpretation of Bourdieu's work on how power influences

learning, and how this affects cultural and social capital as coaches develop over time (e.g., Watts & Cushion, 2017), Webb and Leeder (2021) interviewed four novice sport coaches before, during and after they completed their course. Findings suggested that coaches' dispositions and coaching theories were largely determined prior to the course beginning, but that these evolved over the course of completing the qualification and continued to change afterwards. As an example, a shift away from coach-led practices and autocratic behaviours was observed because of engagement with the entry level qualification (though the authors were careful not to assume that longer-term changes to practice would be evident as they did not have observational data to substantiate this).

Though in its infancy, research examining longitudinal changes and differences between coaches that do and do not undertake formal training and education, whether through NGB-led coach training, coach education in the form of sport coaching degrees, or CPD offered by a variety of agencies invested in sport and physical activity instruction and coaching, offers an insight into the impact that learning has on coaches' knowledge development and subsequent changes in practice, though a disconnect between knowledge and situated action is often observed (e.g., Stodter & Cushion, 2019b).

The Role of Higher Education in Sport Coaching

A critical role of formal education in further and higher education settings is to prepare students for their future professional endeavours, and therefore plays a crucial role in the expertise development process. The goal of further and higher education should therefore be to introduce students to knowledge representations,

ways of thinking, and social practices that define success (Elvira et al., 2017). Sport coaching programmes, in the form of undergraduate sport coaching degrees, have gained popularity in the past two decades, with specific standards and requirements proposed for such programmes to facilitate the development of coaches' ability to effectively support athletes and teams (Lara-Bercial et al., 2016). Traditionally, such programmes contain subject areas such as research methods, sport science, pedagogy, and optional modules focused on more specialised endeavours such as coaching children, the elderly, or the disabled (Cronin and Lowes, 2016). Though it would be difficult to argue that these topics are not relevant to the field of sport coaching, Morgan et al. (2013) have argued that content is not always delivered in a contextually relevant manner and that a divide exists between theory, practice, and reality on many university sport coaching programmes.

Less is known about the impact that sport coach education offered by Higher Education Institutions (HEIs) has on coach learning and development (Trudel et al., 2020). In their review of literature examining research into HEI sport coaching programmes, Trudel et al. (2020) identified thirty-eight articles, of which 24 (63%) were from UK authors and 12 (32%) were focused on an entire degree programme (rather than a module or semester of study). Encouragingly, most of these studies point to observable changes in students' ability to critically explore theoretical concepts related to the craft of coaching, use evidence to inform their sport coaching practice, and adopt reflective techniques to enhance decision-making. Another notable finding from Trudel et al.'s review was how challenging modern approaches to teaching and learning, such as the flipped classroom and case method training,

were for instructors. However difficult, these authors recognised the value of modern approaches to education in fostering a more learner-centred approach, addressing many of the criticisms of curriculum-driven NGB coach training whilst simultaneously encouraging student coaches to be more autonomous and creative in their use and application of knowledge.

A recent example of research specifically designed to explore the relationship between educational background and coaching behaviours by Stonebridge and Cushion (2018) highlights the potential influence that sport coach education can have on sport coaching. Utilising CAIS (Cushion et al., 2012) to systematically observe the coaching practice of ten male professional youth soccer coaches, Stonebridge and Cushion (2018) identified a number of differences between graduate and non-graduate sport coaches, namely higher levels of self- and situational-awareness, greater use of questioning to empower player decision-making, and different practice types during sessions. Though only a small-scale piece of research, with five coaches in each group, this study does provide evidence that educational background can influence sport coaching practice. It could also be inferred that sport coach education, unlike NGB coach training, directly influences the ability of coaches to use knowledge acquired through learning opportunities that present themselves.

Notwithstanding the potential of sport coaching degrees to increase the knowledge and skills of sport coaches, previous experience as a performer still has more relevance to many, including employers (e.g., Blackett et al., 2017) and participants (Cushion and Jones, 2014). In addition, credible concerns have been raised about the potential for missed opportunities in development of key skills for coaching by

undergraduate sport coaching students (Hall, et al., 2019), including limited practical coaching experience and no recognised coaching qualifications for many graduates of such programmes.

Coaches Preferred and Actual Sources of Knowledge

Much of the work discussed so far in this review has centred on specific observations related to coach training and education, namely a lack of engagement by qualified coaches in Continued Professional Development and/or higher levels of National Governing Body coach training programmes. However, recent examples of research conducted in the UK, Canada, Australia, and Turkey, highlight the paradoxical nature of this observation when exploring the barriers to access and use of (sport science) knowledge by sport coaches.

Erickson et al. (2008) used structured interviews (in the form of telephone survey) to examine actual and preferred sources of coaching knowledge in coaches described as 'development level' (coaches working with mostly younger athletes pursuing a performance trajectory; Lyle, 2002). Of particular interest to this thesis was the authors motives to explore this topic area; the evidence, including Trudel and Gilbert (2006), suggesting that coaches learning needs are not being met by traditional, more formal coach education. Within their sample were twenty-one coaches (47.7%) who aspired to becoming coaches of high-performance athletes in the future. Using a ranking system to compile the frequency of the most-cited sources of preferred and actual knowledge sources, the authors identified 'Learning by doing' (58.4% of the sample), 'NCCP' (Canada's National Coaching Certification Program, akin to National Governing Body awards in the UK; 32.7%) and 'Interacting with others' (42.7%) as the

most often mentioned *actual* sources of coaching knowledge. Coaches *preferred* sources of knowledge were through 'Mentoring' (48.5%) and 'NCCP' (51%). Erickson et al. (2008) do not expressly describe the percentage of coaches that ranked 'Interacting with others' as a preferred method of sourcing coaching knowledge, rather they acknowledge that this category was very similar to its counterpart in the *actual* category instead.

The findings of Erickson et al. (2008) both support and oppose the findings of previous literature, in that they recognise participative (i.e., informal) forms of learning, such as socially engaging with other coaches through mentoring and observation, whilst also acknowledging the importance to the coaches in their sample of more formal methods, specifically Canada's National Coaching Certification Program. The latter finding that coaches identified formal methods as both an actual and preferred method of sourcing coaching knowledge, could be attributed to the level of coaches participating in the study. Indeed, Erickson et al. (2008) suggest that their participants may rely on this type of coach education because of their primary focus being skill development rather than preparing athletes for higher levels of competition. In contrast to other evidence in the area is the suggestion reported by Erickson et al. (2008) that their findings highlight the need for more mediated opportunities for coaches to access knowledge. They surmised that the discrepancies between actual and preferred sources for 'Mentoring' and 'NCCP' are illustrative of this and interpreted that their coaches were frustrated by a 'trial-and-error' learning process. This inference corroborates the observations by Nash and Collins (2006), who recognised that coaches often admit to having made mistakes by using a trial-

and-error approach in the past, but that it is not until coaches reach higher levels of performance that they are able to do this effectively and consistently. Erickson et al. (2008) concluded that, whilst the content of formal coach education is often too prescriptive, the need for formal education is therefore a requirement of coaches at a developmental level.

Stoszkowski and Collins (2016) used an online survey to examine practicing coaches' actual and preferred methods of acquiring new coaching knowledge. In doing this, the authors identified informal methods, that typically included social interaction, as the preferred method of learning within the participants. Specifically, participants in the study identified the lower-order theme 'Other coaches/colleagues' (including 'Another coach' and 'Sport scientist', amongst others) as the most cited response to the question 'Where did this idea come from?' (38.66%). Alongside other notable lower-order themes 'Internet', 'Practical experience' and 'Reading', the higher-order theme (referred to as an 'Umbrella' theme by Stoszkowski and Collins) of informal learning accounted for 68.91% of all responses. In contrast to what Stoszkowski and Collins were expecting, formal coach training and education courses consisting of 'Coaching course' and 'University/college course', did account for a further 24.65% of the response, with non-formal learning ('Workshop/clinic' and 'Conference') the remaining 6.44%. A lack of criticality and application of knowledge from these courses was observed within the findings of the research. Although the sample in this study covered a wide and diverse range of sports (30), countries (26), age and experience levels, the authors were unable to establish any trends in response when making comparisons between these demographics. Interestingly, it wasn't just

developmental level coaches in this study who recognised attendance at formal learning as an opportunity to acquire knowledge, with similar responses received from novice and expert coaches too.

When responding to the question 'What would you say is your most preferred way to gain coaching knowledge?', informal learning (including peer conversation, observation of others, and mentoring) represented an even greater share of the responses, with 92.63% of the responses relating to this theme and only 1.56% of participants conceding that formal learning was a valuable asset in their development. In evaluating these judgements, participants reported that the higher-order theme of 'Social interaction' was the underlying reasons for why they preferred these methods of learning. Regarding the sport science ('ologies') knowledge that coaches learnt and what they needed to learn, Stoszkowski and Collins' (2016) observed a large discrepancy in the questions regarding what participants had learnt that was useful to their coaching (8.1%), and what they needed to learn (21.13%). This discrepancy could be accounted for in the participants responses to the same questions regarding coaching pedagogy/practice (66.04 and 45.83% respectively), suggesting that coaches could not acquire sport science knowledge by informal means but that their coaching pedagogy could be enhanced (perhaps to a point of saturation) through similar methods.

In light of these findings, and the observation that participants struggled to articulate why they needed the knowledge they were putting forward, the authors proposed a similar observation to that of Abraham et al. (2006), who suggest that coaches may not possess an appropriate declarative knowledge base on which they can contrast,

compare and evaluate new knowledge or findings. This lack of an 'internal comparator' may lead to inaccurate interpretation of information gleaned from the internet, books, peer-review journal articles, and other self-directed learning activities, and potentially have undesirable consequences. Indeed, Stoszkowski and Collins (2016) reported that 73.07% of their coaches' perceived knowledge acquisition was through 'Uncritical application'. It is worth noting that Stoszkowski and Collins did accept that data collection via online survey may have hindered a full explanation of their research objectives but felt justified in criticising the methods by which coaches accessed new knowledge and information based on their findings.

Though many conclusions can be drawn from this research, of greatest significance to the present study is the inference that, whilst some coaches do utilise the formal coach training on offer, appropriate structures should be put in place to ensure that any informal knowledge development that takes place is done so in a manner which reflects a higher-level of criticality and reflection. An obvious disadvantage of informal learning is that designing formal coach education courses then becomes problematic, since the methods to teach the curriculum become unsustainable, either through them not 'appealing to the masses' or because the content is not suitable. Abraham and Collins (2011) suggest that one reason for this is that it increases the potential for the applied nature of the curriculum to become less applied and therefore less useful to the coaches who opt to attend (or not attend) such programmes. Furthermore, the same authors propose that:

> *'...a cull in coaching science is somewhat overdue. New coach*
>
> *training initiatives often show little or no evidence of a research*

influence, while the subdivision of ideas using 'new and discrete'

topics such as a social or political perspective (Potrac and Jones,

2009) seems to challenge the inherent integration which should

surely characteri[z]e real-life practice. In short, what applied

disciplines need to generate are theories which can strongly

influence professional practice in the real world, where coaching

behaviour, session design, social environment, and playing politics

are all part of the one essential game.' (pg. 367)

In a quantitative study exploring the relationship between perceptions and preferences for knowledge sources and the level of coach training, education, and experience in Portuguese sport coaches, Mesquita et al. (2010) observed that their coaches' perceived knowledge to be from a broad range of sources including playing experiences, formal, informal and nonformal learning situations. Results indicated a preference for experiential learning sources over formal learning provided by NGBs. In comparing coaches with and without an academic background, differences were observed in the value placed on informal and non-formal learning sources, encouraging a cultural shift in the Portuguese context from didactic (formal) coach training to new, experiential approaches to learning. Citing cultural differences as the primary reason for conducting further research into this area, He et al. (2018) conducted interviews with 16 gymnastic coaches from a variety of education and coaching backgrounds and observed that athletic experience, a mentor and formal education were the main sources of knowledge, with increased requirements for formal education when exploring coaches' ideal knowledge sources (though this was

skewed specifically towards an increase in knowledge about sport psychology by the participants in this particular study).

Of the papers presented here, all establish a place for formal learning environments, such as NGB coach training, as part of a broader coach development arrangement that also includes non-formal and informal learning opportunities such as mentoring and communities of practice. These studies also support the notion that a suitable combination of both formal and informal learning creates the best environment for providing coaches with current and useful knowledge in a timely and useful fashion. However, caution should be applied when learning takes place in informal, social environments as this may lead coaches to inadvertently pay attention to the wrong learning cues and knowledge (Nelson et al., 2013). This is further substantiated by Cassidy and Rossi (2006), who discuss the dangers of informal learning environments where the acceptance of practice, convention or knowledge is taken without critique or reflection. They also note the problems attached to the immediacy of such practices, where coaches may correlate a successful outcome in-session with best practice, which subsequently has the potential to promote below-par practices in the future.

What is evident in the literature presented here is that coaches are motivated to develop and learn, but that the value of learning from each other in informal learning environments far outweigh those of formal situations, such as the UKCC and possibly further and higher education. This in part could be due to the value judgement that coaches make about the grounded nature of informal learning, where relevance and direct application support the solving of current problems, whereas formal learning

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is viewed as a more theoretical or cognitive endeavour that may not influence day-to-day practice (Jones et al., 2008). Of equal importance is the commonly shared view in the literature that such informal learning, without some structure or direction, has the potential for the propagation of false information or inadequate practice. It could be argued that these observations provide some conjecture as to how and why coaches do not access contemporary sport science knowledge in their practice, namely that coaches access new knowledge through informal means and that these social interactions often do not involve a sport science practitioner or someone knowledgeable about the sport sciences.

Coaches' Perceptions and Use of Sport Science

Whilst much can be gleaned from the research examining sources of knowledge and transfer in sport coaching, research has also been conducted examining the sport sciences and how they are perceived and applied in a sport coaching setting. A body of doctoral work by Williams (2005) and the published research that has emanated from it, centred on establishing a clearer understanding of the perceived research and practice needs of elite coaches in Australia in relation to sport science, is worth interrogating independently of other research in this area since much of the extant literature that has followed has focused on different aspects of the findings of this work.

Specifically exploring the perceptions of coaches and sport scientists research needs, Williams and Kendall (2007a) surveyed 222 coaches from 19 sports, and 125 researchers from a mixture of both University and Institute of Sport backgrounds in Australia, followed by a semi-structured interview with a random sample of 25

participants (15 coaches and 10 sport scientists), specifically exploring the indecisive or discrepant answers from the survey. In examining the preferences for research areas, Williams and Kendall (2007a) found that eight of ten areas put forward in the survey were similar between elite coaches and researchers, with major discrepancies between 'Mental preparation' and 'Recovery strategies'. Follow-up interview showed that this was primarily due to coaches feeling that they lacked knowledge in mental preparation (despite significant amounts of research being conducted in this area). In contrast, researchers felt that recovery techniques were a priority area for research that would offer the greatest benefit to athletes. Although this finding is not dramatic on its own, what was concerning was that coaches and researchers ranked nine of the ten research areas differently with two-tailed statistical difference ranging from p = 0.0001 to 0.03, suggesting that coaches and researchers agreed on little when it came to the prioritising of sport science research in Australian sport.

Another notable finding was the significant differences observed between coaches and researchers on the perceived qualities of each other. In comparing the perceived qualities in elite coaches, the coaches themselves rated 'Success of athletes under supervision' and 'Years of experience' as being more important, whilst researchers reported 'Keeping up to date with latest developments' and 'Rapport with support personnel' as being key features of a successful coach. Predictably, similar differences were observed when comparing perceived qualities of researchers, with coaches emphasising factors associated directly with sport interaction (with knowledge of the sport and experience in the environment being foremost), whilst researchers placed

more emphasis on factors associated with research pedigree, such as presenting at conferences and publishing in peer-review journals.

When exploring these findings in more details, preferred method of communicating findings and keeping up to date with recent developments appear to be the main reasons for these differences. Specifically, Williams and Kendall (2007a) reported that coaches favoured end-user communication methods, such as conferences dedicated to coaching, workshops, and sport-specific magazines, whereas researchers favoured the higher esteem and integrity of peer-review publications. Interestingly, and notwithstanding these differences, coaches and researchers unequivocally agreed that researchers *should* be publishing in more easily understood language and that research often takes too long to inform practice and answer questions important to the coach and their athletes. Although not unexpected, given the context within which the study was being conducted, the findings of Williams and Kendall (2007a) support the perception that discrepancies exist between the perceived needs of sports coaches and their sport science counterparts.

The work of Williams and Kendall (2007a) is mirrored by many of the findings in a recent piece of research conducted in the UK by Malone et al. (2019). Exploring the perspectives of UK academics and coaches about collaborative sport science research in professional team sports, Malone et al. (2019) reported discrepancies between researchers and coaches in preferred methods of communication, whilst also recognising that buy-in and funding were potential barriers perceived by academics. Importantly, Malone et al. (2019) recognised the value of forming research collaborations between sport scientists and coaches, though compromise would

need to be reached on the type of research (fast, informal vs. slow, quality controlled) that took place.

In a second paper published by Williams and Kendall (2007b) profiling the research conducted in Australia between 1983 and 2003, the authors reported that, of the 725 papers reviewed, most research conducted in the sport sciences was monodisciplinary in nature with a limited amount examining areas more akin to multidisciplinary (i.e., end-user specific) themes and topics. Specifically, studies exploring physiology, psychology and biomechanics accounted for 37.3%, 19.4% and 14.3% of the sample respectively. Quite alarmingly, considering the authors earlier findings that coaches requested latest research to be reported in a lay-person format, only 3.6% of the total sample was published using a case-study or similar format and the methods being employed in the studies were mostly experimental (and hence laboratory-based) in nature, suggesting that basic research was the primary objective in most cases. In contrast to their previous assertion that coaches wanted more research to be conducted in the field of sport psychology, Williams and Kendall (2007b) also found that only a limited number of studies were being conducted in this area where elite athletes were participants.

It is important to note that differences between coaching practice and the endeavours of sport science researchers in publishing new findings should not necessarily be viewed as negative. As discussed by Spurway (2005), a great deal of sport science research is conducted in the laboratory examining new protocols, procedures, and variables that (in the future) may impact on performance. This is further supported by Stone (in Haff 2010), who categorise sport scientists as either

service providers, whose primary role is to regularly monitor the progress of athletes, or researchers, who are primarily involved in hypothesis generating and testing paradigms. That said, however, there appears to be a body of literature that suggests an incongruence between sport needs (specifically, the needs of the coach and their athletes) and the type of research and practice being conducted in many areas of the sport sciences. Furthermore, and as Williams and Kendall (2007a) reported, these two different agendas (i.e., those of the service provider and researcher) have not necessarily been made clear to sport coaches and/or that coaches don't understand the importance of both basic and applied research, as defined in Thomas, Nelson and Silverman (2010), in enhancing and sustaining performance.

On this subject, Spinks (1997) remarked that there were differences between the research aims of sport scientists and what coaches perceived as being important to improve their coaching practice. Spinks suggests that coaches 'think' that they need to know different things to the research being conducted at the time, suggesting implicitly that the need for better coach education and development was fundamental to reducing any gap between coaches/athletes and sport scientists understanding. As with Williams and Kendall, Spinks (1997) also observed that much of research conducted in the sport science field was of a monodisciplinary nature, whereas many 'problems' found in the performance context were multidisciplinary, and therefore not conducive to direct application to the performance field.

Efforts have been made to identify the research needs of coaches and athletes in the past, with these monodisciplinary research paradigms to the fore. From a British perspective, the British Association of Sport Sciences (BASS; BASES, at the time of

writing) established three expert panels to review the research needs of the three main sport science disciplines; physiology (Jakeman, Winter and Doust 1994), psychology (Hardy and Jones, 1994) and biomechanics (Yeadon and Challis, 1994). In alignment with the sections of BASS at the time, a further paper by Burwitz et al. (1994) explored the multi- and inter-disciplinary problems that could be explored by sport scientists including areas such as talent identification, the aetiology of sports injuries and stress. Despite this recognition, and the need for future research exploring the effects of such factors on performance, limited research to date has been conducted in a multidisciplinary way (Haff 2010). Furthermore, despite Nevill et al. (2001) suggesting that "…there is a need to identify and report regularly contemporary trends, as well as good practice…" (p. 737), none of the articles described above reported that research findings needed to be disseminated to user-friendly sources, such as technical journals and coaching magazines, rather than peer-review scientific journals, as a solution. This is further supported by Goldsmith (2000), who suggests that findings of research reported in more appropriate lay-person forums (such as coaching courses) would be more useful to coaches and athletes.

Williams and Kendall (2007a) suggested two significant obstacles to making more effective use of sport science research in Australia. Firstly, in the context of making findings available to coaches, much of the research being conducted in Institutes of Sport was unpublished. Secondly, the research that was being published (mostly in university settings) that purported to be for the benefit of elite sport was, in fact, being undertaken using undergraduate students as participants. Acknowledging that research with elite athletes can be difficult for many reasons, Williams and Kendall

argued that inferring findings to the elite sporting environment using pseudo-elite athletes was redundant (see Nevill et al., 2008, for further discussion).

Citing the work of Williams as inspiration, Reade et al. (2008a) similarly examined perceptions, preferred sources, and barriers of knowledge transfer from the sport sciences in Canadian coaches. Though the coaches were not high-level using the operational definition of expertise in this study, the participants did have additional access to traditional sources of sport science knowledge (peer-review journal articles) because of coaching at an inter-university level (in the UK, the equivalent of British University and Colleges Sports, BUCS). Despite this, the study reported similar findings to other studies where coaches didn't have access to such knowledge. Namely, that coaches preferred informal learning through consultation with peers, rather than access their knowledge first-hand from scientific publications. Unsurprisingly, they surmised that the problem would be worse when coaches were not located in a university environment where access to high-quality research was not a problem. Rewarding sport science researchers for transferring knowledge into more accessible formats was suggested by Reade et al. as a pragmatic strategy to enhance the transfer of research more readily into practice.

Building on this, Martindale and Nash (2013) investigated the perceptions of sport science from coaches representing a wide and diverse background, including different sports (Football, Rugby League, Curling and Judo) and level (high-performance[5], developmental and novice) in the UK. The presenting problem, as

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[5] Martindale and Nash (2013) use the term 'elite' to describe their highest-achieving coaches

Martindale and Nash (2013) described it, was that the transfer of sport science knowledge to coaches has been poor at every level of coaching, and that understanding opinions and perceptions of the subject could lead to a more systematic and effective implementation of contemporary sport science knowledge in preparing athletes at all levels of competition. Using Lyle's (2002) definitions of novice (UKCC Levels 1 and 2), developmental (Level 3) and elite (Level 4), the authors conducted a combination of focus group and semi-structured interviews with the primary purpose of exploring experiences and opinions of sport science. Of particular interest was the participants' consistent recognition of three emerging challenges to sports coaches in their use of sport science in their day-to-day practice, namely application and relevance, integration and access, and language.

Citing Williams and Kendall (2007a) and Reade et al. (2008) as further corroboration, Martindale and Nash (2013) reported that many of their participants perceived sport science as only being important and relevant to the highest-level of athletes, and that many of the participants questioned the need for the inclusion of such content in lower levels of coach education courses. They concluded that this was primarily down to their participants being unable to define and understand sport science adequately, and subsequently recommended that coach educators and sport scientists collaborate on ways to enhance this aspect of the delivery of coach training and certification courses. Given the previous observations in this review, regarding coaches' preference to develop knowledge through informal methods where possible, it is no surprise that the consensus in the wider literature is a lack of

connection between coaches' access and use of sport science knowledge from formal coach training and elsewhere.

Further reinforcing observations made by Williams and Kendall, both Reade et al. (2008) and Martindale and Nash (2013) recognise difficulty in accessing sport science knowledge as a significant barrier to implementation, citing the main barriers to access being the resources required (paywalls associated with peer-reviewed journal access), the time required to read and understand new research, and the lack of direct access to a practitioner to 'make sense' of research findings, though Reade et al. were careful not to infer from their findings that the level of education of their participants had any bearing on the barriers to accessing sport science knowledge. These studies reinforce the perception that, whilst some coaches in their studies recognised sport science knowledge as a valuable ingredient in preparing athletes, some coaches did not perceive that they had sufficient access and understanding of sport science knowledge from peer-review journals and other avenues of published research to take advantage.

Notwithstanding lack of access, the need for some translation of sport science knowledge and information was also identified. That is, researchers identified over-use of academic terminology as being a barrier to engagement with sport science, an often-reported problem in the extant literature (Sands, 1998), although several participants in Martindale and Nash (2013) recognised the need for the inclusion of some of this 'jargon' to prepare coaches to work at the next level. Martindale and Nash (2013) did acknowledge in their study that this observation was isolated to two sports within their sample - those of Football and Rugby League - suggesting that

there may the need for further investigation at a local (i.e., National Governing Body) level to establish the extent to which this problem exists. Furthermore, these authors conceded that the 'publish or peril world' (pg. 818) where most sport science research is housed does not lend itself well to the dual need to publish research in academic journal publications and more user-friendly coaching publications.

An important adjunct to the accessibility conversation is that of the ability of practitioners (and de facto, coach developers) to convey and apply their knowledge in coach- and athlete-friendly environments. Martindale and Nash (2013) report that the ability of the sport scientist to apply their knowledge effectively in the required context was, in the eyes of the coaches interviewed in their study, as important as the practitioners' level of knowledge itself. This, coupled with the concern that sport scientists integrating with the existing team of coaches and athletes may prevent effective athlete development, led the authors to suggest that the training of sport scientists should include methods to engage coaches and athletes (rapport building, active listening, empathy etc.). A further suggested implication of these findings was that administrators within National Governing Bodies and other commissioning agencies need to resource the time required for sport science practitioners to gain acceptance, familiarity and respect from the coaches and athletes with whom they work. In other words, time being in and around the training and competition environment is of direct benefit to the coach, athlete and practitioner and would facilitate greater access and use of the sport science knowledge available to sports coaches.

Using a translation of the questionnaire used by Reade et al. (2008a), Kilic and Ince (2015) conducted a similar study exploring perceptions, sources and barriers to effective use of sport science knowledge by Turkish coaches. Amongst the 321 coaches that participated in their study, 79.8% believed that sport science contributed to sporting performance. Similar to previous research, findings recognised a knowledge-practice gap where sport science research was concerned, with coaches ranking peer-review scientific research low in acquiring new knowledge. Differences in both perceptions and preferences were identified based on a number of demographic features, including gender, context, setting, academic background and coaching level. Consistent with the research from Australia, Canada and the UK, coaches reported a preference for informal learning opportunities, including other coaches.

In a follow-up to their study exploring perceptions and barriers to sport science, Reade et al. (2008b) adopted a case-study approach in examining the type and sources of information that elite coaches use to form knowledge of the sport sciences, and whether this knowledge impacted on their practice. Using a sample of the same participants, the authors established that their sample were keen to work more closely with Sport Scientists and explore their ideas, and that they valued the knowledge and application that sport science could provide. However, most respondents still identified more expedient methods of gleaning latest ideas (their peers and coach-led seminars) because of having no interest in academic publications. These finding further support the problems discussed previously regarding the gap between sport science knowledge and coaches effectively using

this knowledge to enable higher levels of performance in their athletes. This is despite several attempts in the literature to encourage sport scientists to make more effective use of coaches' knowledge, more specifically experiential knowledge, in determining research questions (Burwitz et al. 2004; Greenwood et al. 2012; Foster, 2019).

In a published roundtable discussing the current and future impact of sport science on high-performance sport success, Haff (2010) brought together experts from their fields from the United States of America, Europe, Australia, and Japan. Whilst acknowledging the view that sport science can have an impact on performance when the systems and support structures allow for it, these experts also reported similar findings to those discussed earlier regarding poor communication between the researcher/practitioner and the coach. More specifically, they noted that many coaches did not have the knowledge and skills to understand research being reported, but that sport scientists amplified this two-way problem by not reporting findings in coach-friendly publications (a recurring theme in this review of literature). When considering these two themes (i.e., that coaches do not have the knowledge and/or access to read scientific publications, and that researchers and practitioners need to make more effort to publish findings in more supportive media), Bishop (in Haff 2010; Bishop, 2008) proposed a model for bridging the gap between the scientist and the coach. The key features of this model were the close collaboration between coach and scientist on generating questions and evaluating them in ecologically valid settings.

The most recent attempt to challenge the degree to which sport science research is translated into knowledge of benefit to sports coaches comes from a body of work from Fullagar and colleagues focused on perceptions of evidence-based practice in US and Australian professional sport (Fullagar et al., 2019a; Fullagar et al., 2019b; Schwarz et al., 2021). Citing Coutts' (2017) editorial discussing the challenges of developing evidence-based practice in sport, these studies recognise the complexities of studying and understanding the multidisciplinary settings prevalent in sports training and competition. However, echoing the previous discussion points in this literature review, surrounding differences in preferences and perceptions of practitioners (i.e., sport scientists and coach developers) and coaches and athletes (e.g., Williams and Kendall, 2007b; Reade et al., 2008b; Kilic and Ince, 2015), they acknowledge that many of the barriers to successful implementation come as a result of dysfunctional or under-developed relationships between coaches and coach educators and that research questions do not always align with coaches' knowledge needs with Fullagar et al. (2019b) recommending increased integration of staff into coach settings as a potential solution to these observed discrepancies.

The authors recommend the often-mentioned collaboration between researchers and coaches when developing research questions and the adoption of more purposeful approaches to teaching and research in universities. Given the observations made by Burwitz et al. (2004), and discussed earlier in this review, this author would also contend that these questions need to be multifactorial in nature and consider the athlete(s) in a more multidisciplinary way in complex training and/or competitive environments, as discussed by Malone et al. (2019) in their examination

of applied collaborative sport science research and discussed by Alfano and Collins (2021 in their recommendations for good practice delivery in sport science and medicine support.

In summary, despite research documenting some of the challenges associated with sport coaches' access to and use of contemporary sport science knowledge and research findings, and recognition of some of the potential solutions to this, little has changed to suggest that there have been positive and meaningful steps forward in this regard. Though not exclusively, research focused on more athlete-centred, multidisciplinary problems, and the publication of these findings in more accessible formats, seem to be the most popular solution within this narrative.

Summary of the Chapter

Several attempts have been made to document and describe how coaches learn to learn and learn to coach, using a variety of less- and more-skilled/experienced coaches as participants and adopting different definitions and classifications of knowledge, learning, expertise and professional development. Whilst this increase is positive in establishing the credibility of coaching as an evidence-informed vocation, and in showing the significance of how research in the field has grown and evolved, it could be argued that much of the more recent research has become increasingly esoteric in nature (Abraham and Collins, 2011; Stodter and Cushion, 2017). That is, one of the challenges with addressing the complex demands of coaches and coaching, and ensuring that their knowledge is always current, is the danger that the approaches used to acquire and transmit the knowledge become less and less useful to the intended population as a result of the over-emphasis on the specific context

within which the coach is working. This lack of vocational application supports the contention of Rynne and Mallett (2014) who describe expert sport coaches as 'learners by necessity'. Furthermore, the same authors suggest that the findings of their study, couched within a framework of examining whether coaches' learning influences sustainable practice, support the suggestion presented in much of the literature to-date. That is, that coaches prefer to use unmediated and informal learning opportunities (learning on the job, discussion with others etc.) over mediated opportunities such as formal NGB coach certification and taught courses provided by further and higher education.

Notwithstanding this. these studies offer a useful insight into the strategies and methods adopted by sport coaches to acquire and implement knowledge in a variety of settings, whilst also placing doubt on the role of formal coach training courses delivered by National Governing Bodies of sport. A common finding in these studies is that a discrepancy exists between rated importance and the perceived quality of formal means to acquire knowledge through such courses. Further agreement is met when the importance of informal and non-formal learning opportunities, such as through mentoring, experience of competing and playing, and opportunities for discussion with peers, are discussed. However, whilst informal learning is recognised as being an asset in the development of coach knowledge, it is often considered synonymous with low-quality learning that lacks criticality and reflection. Motivation of coaches to continue learning following qualification has also been challenged within this research, with debate surrounding Continued Professional Development (CPD) and licensing often framed within the same conversations.

Sufficient evidence exists within the literature to support the contention that sport science knowledge can be of benefit in supporting coaches in achieving success with their athletes and teams, but that some discrepancies exist between end-users (i.e., the coaches) and researchers perceived needs of research and practice in the sport sciences. Typically, research in this area has found that, whilst coaches want more knowledge, barriers to this include access and complexity of language, limited 'buy in' from NGBs, cost (particularly amongst the mostly voluntary coaching workforce in the UK), and preferred methods of presentation. Conversely, similarly themed research has suggested that the biggest barrier to coaches effective use of this knowledge is the coach themselves (e.g., poorly skilled in understanding published research), negligible reward for researchers to publish findings in coach-friendly publications, and the lack of direct application of research findings to real-world scenarios and in-situ performance problems.

Research exploring how expert sports coaches perceive and access knowledge from the sport sciences would be of great benefit in understanding how to enhance existing coach training and education, as well as inform best practice for coach developers. Building on previous work that has explored the somewhat dichotomous relationship between the coach and researcher, further examination of coaches needs and any barriers to implementation would also expand existing understanding. Furthermore, a better understanding of the location of sport science knowledge in the sport coaching curriculum would provide context and meaning to the conversation as well as placing this thesis in the author's professional domain.

Study #1: Expert Coaches Perceptions of Sport Science Knowledge

Methods

The first study presented in this thesis aims to explore expert coaches' perceptions and access to sport science knowledge in preparing their athletes. In addition, this study sought to develop a better understanding of any potential barriers to knowledge acquisition and dissemination that such coaches may face in their day-to-day practice. This chapter will outline the theoretical perspectives adopted within the study, the interview method employed to gather data, and the thematic analysis approach that was adopted. Building on previous research defining expertise in sport coaching, the chapter will also outline a modified operational definition of expert coaching that was used in the recruitment of participants. This will allow the reader to recognise the level of sporting (and coaching) performance that the first study was focused on.

Methodology

As previously discussed in the review of literature, it was important to reflect on the values, meaning and beliefs underlying how, why, and where coaches accessed knowledge pertaining to the sport sciences. Much of the previous literature has explored this from an objectivist ontology, where attempts to identify the problem have been made without offering any plausible (or at least well- rounded) explanations as to how and why the problem manifests itself (Parry, 2005). With this in mind, it was felt that an alternative approach to data gathering and analysis should be adopted in this study. Identifying the most appropriate research design in this way is supported by Sparkes and Smith (2014), who suggest that the 'problem' (research

question) should define the approach and methods used. They also, however, highlight the notion that the opposite of this could be true - that the theoretical background and assumptions of the researcher can influence the methods employed.

This research adopted an approach that can best be described as adhering most closely to the interpretive/constructivist paradigm. Such a paradigm aligns itself with constructivism as an epistemology and describes reality in a social context and is assumed to be relative rather than absolute in nature. As such, knowledge is sought through establishing social norms and values from the participants and is therefore a subjectively determined 'wisdom' (Lyons and Coyle, 2007). Significant to this study is the assertion that a circular relationship exists between the individual and the reality that they create, as a result of socialisation and the cultural influences that play a part in day-to-day interactions with others. Previous studies conducted with Canadian and Australian sports coaches (Williams and Kendall, 2007a; Reade et al., 2008a) have alluded to some of these contentions.

Yin (2011) highlights the key features of this approach, including the potential for duality of interpretations of human events, that knowledge and meaning are co-constructed and emerge from the interaction between different people (in this case, the researcher and the participants), and the emphasis of the research on uncovering context-specific description through the eyes of the participants (i.e., expert sport coaches in performance settings). Yin (2011) also stresses how an approach that uses methods aligned to a qualitative perspective can examine research questions that are not constrained by experimental conditions and where only a small sample size is available for gathering responses. In the present study, the nature of the participants

involved would preclude a more objectivist approach used in other studies of a similar nature (for example, the survey approach adopted by Williams and Kendall, 2007a, who had unlimited access to high levels of sport coach as a result of Williams' occupation), not to mention that an important dimension of this study (the opportunity for a rich description of the context and situation offered by the participants) would be missing if such an approach were to be adopted.

Much of the previous literature examining the perceived dichotomy between practitioners and sport coaches regarding the need for sport science, have used a survey approach that has constrained the response to questions by using Likert scales or closed questions (Williams and Kendall 2007a; Reade et al. 2008a). The result has been the reporting of a somewhat consistent stereotype of sport scientists (they write their research for other researchers, and the questions that they explore rarely impact on performance outcome) and coaches (they lack the knowledge and skills to understand and interpret mainstream research published in peer-review journal articles and prefer networks of peers to acquire new knowledge rather than attend coach education courses). Whilst some of these generalisations have been supported in research applying a richer methodology (Martindale and Nash 2013, who identified through their interviews that relevance, access and language were significant barriers to elite sport coaches employing sport science in their practice), a methodology that employs interview can explore these assumptions in a way that avoids unnecessary over-generalisation and stereotype.

Importantly, this approach also assumes that bias from the researcher influences the process. As such, awareness and acknowledgement of the values and beliefs of the

researcher, and the ability of the researcher to understand how their values and assumptions may influence the interpretation of any data gathered, is a central tenet of qualitative research. Clarke and Braun (2013) further expound this position by explaining how both *insider* and *outsider* positions, commonalities (or not) between the researcher and the identity of the group (participants), can influence this. This partiality, or at least acknowledgement of such within the research paradigm, is an important reason for conducting the research in this way. It is also arguably one of the greatest weaknesses of this type of research.

Permission to conduct the study

Ethical approval was received for the study from the Faculty of Health and Wellbeing Ethics Committee at Sheffield Hallam University (Appendix A). Since techniques used were non-invasive, and the line of questioning was not considered to be emotionally or psychologically upsetting, procedures were deemed minor regarding risk.

Study Population and Sampling

Expert sport coaches (n=8) were purposively recruited through a variety of methods, including professional networks and social media and gave permission via informed consent (Appendix B). Since the researcher was a member of an academic sport department, there were several professional avenues to explore as part of the participant recruitment process. These included contact with postgraduate students studying sport coaching and colleagues who met the inclusion criteria for the study. A number of studies have espoused the virtues of using social media as a recruitment tool for hard-to-find participants, including recent examples by Topolovec-Vranic and Natarajan (2016), and Burton-Chase et al. (2017). Importantly, to ensure the

credibility of the participants recruited using this method, closed professional groups that the primary researcher was a member of were used for this purpose.

For the study, any coach that possessed at least a Level 3 (or equivalent) UKCC (United Kingdom Coaching Certificate) coaching qualification was considered. In the UK, a Level 3 UKCC coach is operationalised as a 'head coach', with responsibility for all aspects of their athlete's development. In the context of this study, an expert coach satisfied a modified version of Swann et al.'s (2015) criteria for high-performance athletes, with an additional modification to the first criteria to be inclusive of expert age-group athletes, and therefore participants:

- regularly supervised athletes selected to represent their country, possibly in 2nd tier competition
- had athletes able to demonstrate at least infrequent success at international level or in top tier competition
- had a minimum of five years experiences at their highest level

Since the focus of the study was on coaches' access of sport science knowledge, it was felt that this would provide the participants with sufficient exposure to this sort of knowledge to provide an in-depth and well-informed point of view. It also satisfied the definition of proficient/expert, as outlined by Dreyfus and Dreyfus (2004) in their work around professional development.

Although the inclusion criteria significantly reduced the available pool of participants, it ensured that the findings of the study could be applied directly to expert coaches

as well as offering richer and more meaningful data. Table 4 provides some additional information on the participants recruited for the study.

Table 4: Participant Details for the Study

Participant	Sex	Sport	Experience
P1	M	Trampolining	10 years +
P2	M	Fencing	5 years +
P3	M	Basketball	10 years +
P4	M	Tennis	5 years +
P5	F	Volleyball/Rowing	10 years +
P6	M	Cricket	10 years +
P7	M	Para-Cycling	10 years +
P8	M	Rugby Union	10 years +

Design of the Data Formulation Technique

This research used loosely structured, often referred to as semi-structured, interview as a data gathering tool. Kvale and Brinkman (2009) use the phrase 'data formulation' rather than data collecting to offer a contemporary understanding of what qualitative research situated in a constructivist world view constitutes. Namely, that the interviewer co-produces the data as part of an 'inter-view', or '...an inter-change of views between two persons conversing about a theme of mutual interest.' (Kvale and Brinkmann, 2009, pg. 2). Implied in this definition is the interdependence of knowledge created by the participants (expert coaches) and the primary researcher (a coach and academic leading physical education and sport coaching courses at a large university).

Patton (2002) refers to this approach as the general interview guide approach, whilst Fielding (1996, cited in Punch 2014) describes it as being semi-standardised. Regardless of nomenclature, this approach sits somewhere in a continuum between a closed-question, survey-style approach to interviewing (structured) through to an open-ended approach that evolves as the line of questioning develops (unstructured). Mason (2002) describes research interviewing as an '...in-depth, semi-structured or loosely structured form of interviewing.' (pg. 62) and suggests that the term 'unstructured' is a misnomer, since it implies that no preparation is required when it clearly is to enable the researcher to gather any useful and meaningful data.

The approach also affords the researcher the opportunity to prepare questions in advance, but with the freedom and flexibility to explore and probe answers of interest during the interview. Hugh-Jones (2010) describes this as '...social interaction that can constitute data.' (pg. 81) and reinforces how key themes emerge rather than being extracted from a pre-determined route or line of questioning (Kvale and Brinkman, 2009). As an experienced interviewer, this approach also permitted the primary researcher sufficient direction to ensure the collection of high-quality qualitative data from the interviews conducted (Seidman, 2006; McNamara, 2009, cited in Turner, 2010). Other attractive reasons for selecting this approach to data formulation include the flexibility in research design that it offers and how it can challenge generalisations (Berg, 2001). Qualitative approaches to research design provide the researcher with an opportunity to employ an iterative (and therefore flexible) approach to questioning that evolves with the participants (Maxwell, 2008). Given the backgrounds of the coaches recruited for this study, adopting this approach

offered the researcher a set of circumstances that justifiably permitted changing the order of interview questions, and probing in unusual ways dependent on their responses.

Designing effective research questions is a critical aspect of the interview design process. Marshall and Rossman's (2016) cycle of inquiry, a schematic that shows the relationship between theory, practice, personal experience of the researcher and the research question itself, suggests that the design of a research project can begin at any point during this complex, but logical process. The design of the interview guide for this study followed a similar path, in that personal experience, observation and previous literature were all used in formulating the initial set of questions used in the interviews.

Furthermore, as described by Hopf (2004), loosely structured interviews usually have some sort of theoretical framework underpinning them. In this case, the interview guide was heavily influenced by the line of questioning used by Williams (2005; Williams and Kendall 2007a) who explored the relationship between elite coaches' perceived sport science needs and research and practice and whose Elite Sports Science Research Model (ESSRM) evolved from the data collection from those studies. Additionally, because of advancements in the understanding of coach training and education between 2005 and the present day, the evolution of the UKCC and popularity of sport coaching degrees, questions were altered to reflect a more contemporary, UK-centric position.

Berg (2001) highlights the use of certain strategies in constructing interview questions that avoid researcher bias and help facilitate the flow of an interview,

namely affectively worded, double-barrelled, and complex questions. Berg also recognises how 'The arrangement or ordering of questions in an interview may significantly affect the results.' (pg. 79). As such, the interview guide was developed around six themes or sub-sets of questions that were sequenced with questions designed to develop the participant's confidence (in both the conversation and interviewer) at the start of the interview. The six broad themes, with two core questions in each theme, were: background, qualities, priorities, barriers, communication, and translation. The interview guide can be found in Appendix C.

Trialling the Data Formulation Technique: The Rehearsal Interview

As described by Turner (2010), an important aspect of effective interview preparation is the conducting of a rehearsal (or pilot) interview. The purpose of the rehearsal was to establish any flaws or limitations of the interview questions and the resultant conversation, and to allow for revisions as necessary. For the pilot, a Weightlifting Coach who met the inclusion criteria for this study was deemed a suitable rehearsal candidate and took part in a 75-minute interview with an early draft of the interview schedule as part of a module assignment for the primary researcher's Doctorate of Professional Studies. Whilst the interview was informative and provided some unique insights into the research question (the participant was an academic colleague of the primary researcher and therefore had some views and opinions from the perspective of being both a coach *and* sport science practitioner), it was evident from this early rehearsal that the initial set of interview questions needed refining.

The skills of the interviewer to respond to signals and messages from the participant during the interview and provide a welcoming environment for the participant to be

open, candid and honest, is also an integral part of any successful interview (Turner, 2010). These skills include the ability to develop rapport, the interviewer understanding their role as a self-conscious performer, and the role of social interpretation in communicating and receiving non-verbal messages (Berg, 2001). In describing social interpretation, and the dramaturgical nature of conducting interviews, Berg (2001) defines a successful interviewer as someone who can be actor, director, and choreographer simultaneously in the interview environment. The rehearsal interview therefore also offered the primary researcher an opportunity to hone and refine their interviewing skills, with valuable feedback from the participant (themselves a former Doctorate of Professional Studies candidate with experience of conducting interviews in a similar format).

Data Formulation Procedure: Conducting the Interviews

Following informed consent (Appendix B), participants were interviewed for between 60 and 75 minutes, focusing on how they accessed sport science, their perspectives on sport science knowledge, and how the coaches implement this knowledge themselves. All interviews were loosely structured and voice-recorded, either at a venue convenient for the participant or by telephone. To comply with data protection, all recordings were either stored in a locked desk drawer that was only accessible by the author or on an encrypted (password protected) storage device. All information pertaining to the participants' identity was also removed from the data. As previously outlined in this Chapter, all interviews were conducted using the interview guide presented in Appendix C. However, the order of questions and

probes used to further explore the six themes evolved during each interview as previously discussed.

Thematic Saturation

The very nature of qualitative research, and the focus being on an inherently deeper understanding of a subject rather than making broad generalisations to a wider population, means that sample sizes of research employing interview techniques is smaller than many other forms of research studies (Dworkin, 2012). A critical assumption of this type of research is that the number of unique opinions amongst a sample will be relatively small, given the homogeneity of characteristics within any given population demographic. Despite this, sample size for conducting interview studies has not been fully operationalised despite efforts to do this (Francis et al*.,* 2010; Cobern and Adams, 2020), though Dworkin (2012) cites published examples ranging from between 5 and 50 participants.

Often-cited approaches to determining sample size in interview studies is that of saturation and salience. First introduced to qualitative research in 1967 by Glaser and Strauss (cited in Dworkin, 2012), saturation can best be defined as the point when conducting interviews where little added information is obtained (Weller et al*.,* 2018). As per Charmaz (2006), saturation is therefore reached when 'gathering of fresh data no longer sparks new theoretical insights, nor reveals new properties of your core [theoretical] categories' (pg. 113). This is more likely when longer interviews are conducted, and when the participants are 'lived-in' experts within their field (Cobern and Adams, 2020). Salience is measured by prevalence of occurrence of items mentioned during interview (Weller et al., 2018), and is highly

correlated with saturation in studies exploring sample size in qualitative research (Bousfield and Barclay, 1950, cited in Weller et al., 2018). This study adopted an approach to saturation suggested by Francis et al. (2010), where each interview was transcribed, coded and analysed prior to conducting the next interview, in order to identify an appropriate saturation point. Furthermore, as per Weller et al. (2018), interviews were not timebound and probing continued until the most salient ideas were discussed with participants.

Methods of Data Analysis: Thematic Analysis

Thematic analysis was an attractive option for the present study because of being easy to learn and suitable for researchers with limited experience of analysing qualitative research data (Braun and Clarke, 2014). Additionally, thematic analysis provides the most effective approach for analysing the data in a contextually relevant manner thus allowing it to be accessible to a wide range of audiences (Braun and Clarke, 2006; Howitt and Cramer, 2010). Given the common criticism that much of the extant sport science literature is inaccessible to coaches and athletes (Williams and Kendall, 2007a; Martindale and Nash, 2013), it was important for the findings of the present study to be available and easy to interpret. Furthermore, Braun and Clarke (2006) recognise the flexibility that this approach affords the researcher, providing an appropriate balance between theoretical freedom and methodological robustness.

Often confused with interpretative phenomenological analysis (IPA) and grounded theory (GT), an important distinction between thematic analysis and both IPA and GT is that thematic analysis is considered a *method* rather than a *methodology* (The

University of Auckland), in that the analysis of themes can be used across the epistemological and ontological spectrum (offering theoretical freedom) and offers less-experienced qualitative researchers an avenue to examine a variety of different types of data, including interviews. Whilst it is important to highlight that the thematic analysis method offers theoretical flexibility, it does not imply that the method is used without consideration of the theoretical and epistemological framework within which the research falls (what Braun and Clarke, 2006, refer to as an 'epistemological vacuum'). The constructionist paradigm was the predominant paradigm, hence the analysis for this study employed an approach that can best be described as an *inductive* one.

The use of an inductive approach to thematic analysis implies a 'bottom up' method where the themes generated may not bear resemblance to the questions asked. Importantly, this approach is data-driven, and provides a way to describe the entire data set in the analysis. This contrasts with the alternative approach to a more theoretically bound approach to thematic analysis, whereby the analysis is researcher-driven and focuses more on one aspect of the data collected (Braun and Clarke, 2006). Furthermore, the analysis was conducted at the latent level, where the level of theme generation seeks to explore primary ideas and assumptions that underlie the semantic content of the data (i.e., what is *actually* said). Importantly, a latent level of theme generation affords the researcher the opportunity to hypothesise beyond a descriptive level, and therefore affords a level of criticality within the data analysis.

This study employed the first five phases of Braun and Clarke's (2006) approach to conducting thematic analysis. Phase one involved familiarisation with the data gathered. Interview recordings were transcribed verbatim, and then read and re-read whilst jotting down initial ideas on possible themes. Bird (2005) suggests that the transcription process is itself the beginning of an interpretive act leading to making sense of qualitative data. Phases two through four involved the systematic coding, searching and reviewing of themes across the data set (the interview transcripts) to generate a 'theme map' - an account of the hierarchical relationship between codes. Part organisation and part interpretation, these phases represented an opportunity for the primary researcher to develop a rich understanding of the data. Also important at this stage of the analysis was acknowledgement, and subsequent inclusion, of code that was contradictory (Boyatzis, 1998). As Braun and Clarke (2006) observe, 'It is important to retain accounts that depart from the dominant story in the analysis' (p. 89). Phase five involved the defining, refining and naming of the core themes interpreted from the data set.

Results

The primary objective of the first study in this thesis was to explore expert sports coaches' access to sport science knowledge, develop a better understanding of how coaches' might use this knowledge in their coaching practice, and identify any barriers/challenges pertaining to bridging the gap between knowledge, access, and implementation of sport science in sport coaching practice. Given the paucity of sport science knowledge in entry-level coaching certificates in the UK (i.e., UKCC Levels 1 and 2), inclusion criteria reflected coaches that possessed at least a UKCC Level 3 qualification and had coached at a high-performance level (i.e., as a coach responsible for performance with high-level age-group or adult athletes and teams) for a minimum of five years.

Loosely structured interviews were conducted and then thematically analysed adopting the approach described by Braun and Clarke (2006). On completion of this analysis, three higher-order themes were identified: those of *knowledge acquisition*, *knowledge translation*, and *qualities in practitioners and coaches*. These were further classified into seven second-order themes (where appropriate) and seventeen lower-order themes. Figure 4 displays the themes identified as a result of the thematic analysis.
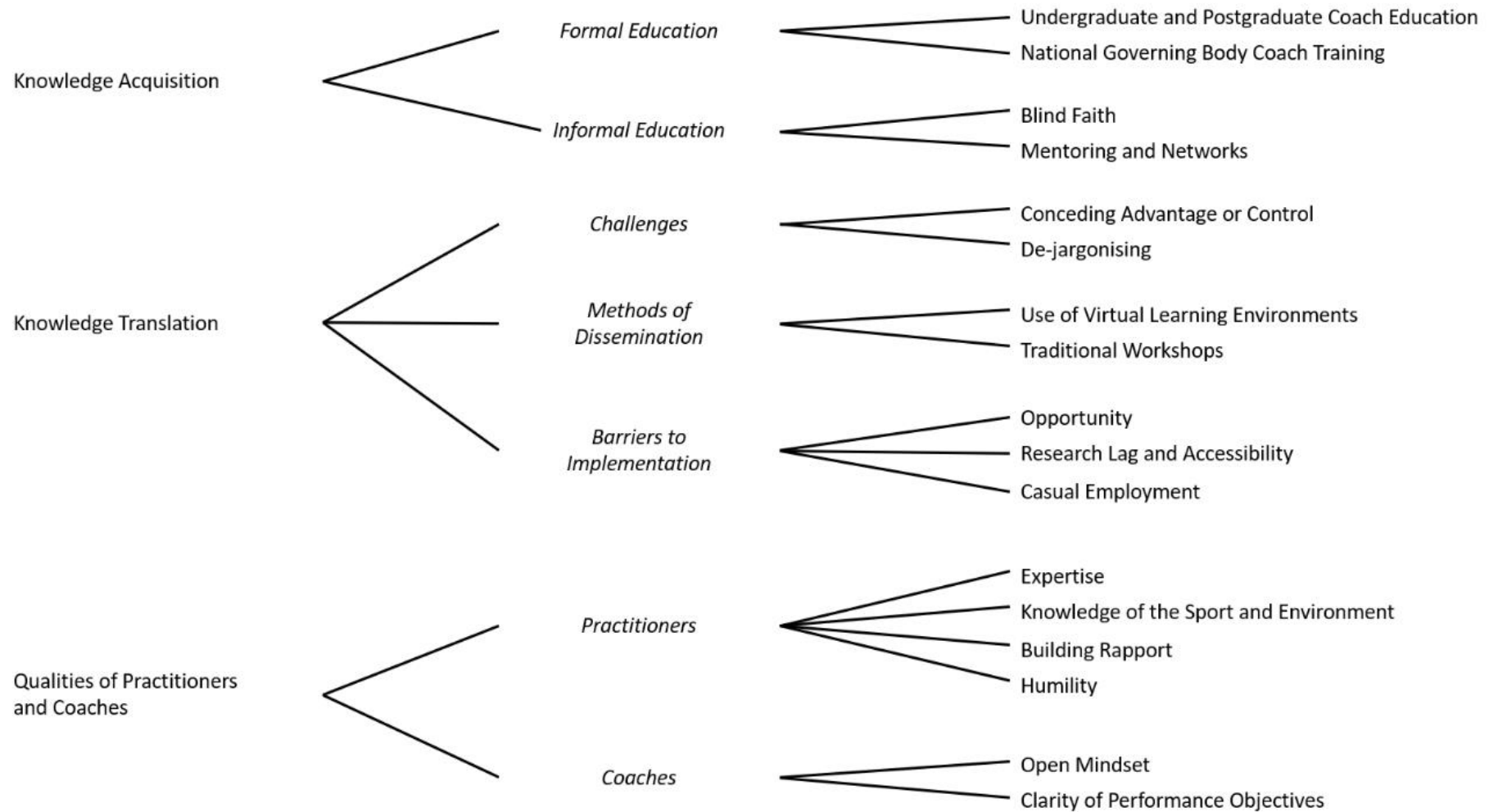
Figure 4: Thematic analysis of the interviews conducted for the first study

Knowledge Acquisition

When discussing how participants accessed sport science knowledge in this study, four different sources were identified, namely *undergraduate and postgraduate coach education*, *National Governing Body (NGB) coach training, blind faith,* and *mentoring and networks*. Using Nelson et al.*'s* (2006) definitions, these were further categorised as being either *formal* or *informal education* (see Figure 4). Owing to the definitional clarity missing in the extant literature (Lyle and Cushion, 2017), a deliberate distinction was made between NGB- and further and higher education-led coach development by using the terms *training* and *education* respectively to describe these distinct coach development offers.

Formal Education

Undergraduate and Postgraduate Coach Education

Participants revealed formal coach training and education, from a combination of Higher Education and NGB coaching certificates, as primary sources of their sport science knowledge. For example, one participant talked about achieving the ambition of having athletes in a national squad without really understanding or recognising their own limits as a coach practitioner, and the identification of a self-development need as a result:

> *So, that's when I decided that I needed to go to university and do a sport science (and coaching) degree, because I realised I had gone all the way through the coaching system, I'd got athletes to National level, and actually really did not understand what elite was*

or producing someone to elite level was. It had almost happened by

chance (P1)

This was further elaborated upon by P3, who discussed the limitations of not having a formal degree-level education when parsing knowledge from academic literature:

If you could access it, if it was free, you probably wouldn't be able

to read half of it, or you'd stop reading it after two pages because

you've got bored or you've come across 17 words that you couldn't

understand, you know, the usual things… (P3)

With sport coaching degrees at both undergraduate and postgraduate level being relatively new in the UK, availability of bespoke degree programmes was raised when comparing the degree-level education of coaches from other nations:

…international coaches, they've all got degrees or postgraduate

degrees in coaching, and it's a lot more structured. You can go and

get a degree in Fencing from a number of Universities, but none in

this country at the moment (P2)

Interestingly, one participant assumed, as a result of the level of coaches included in this study, that all participants would possess degree-level education, further reinforcing the link between coaches' sport science knowledge and their level of formal education:

I would hope as well that, given the level of coaches that you've

been looking to interview, I would hope they've got at least

undergrad … background behind them, if not postgrad (P6)

National Governing Body (NGB) Coach Training

Predictably, coaching qualifications offered by National Governing Bodies (NGBs) were brought up by several of the coaches that participated in this study. The most popular discussion point was that of licensing and, by proxy, continued professional development (CPD) or rather lack of it. For example, many of the coaches discussed the absoluteness of coach awards being granted by NGBs and the 'culture of knowing' that this creates:

> *At the moment there's no revalidation, so you can go out and get your Level 2 qualification and you can coach for the next 20 years, 30, 40 years, without any input from the NGB. If you're that way inclined, it's likely you're not going to go and look at the research and it's going to be difficult for you to find the research because you're not engaging in the CPD* (P2)

> *There tends to be quite a lot of apathy towards developing yourself as a coach. Once you've got the qualification it's like, right, I know everything, I'll go and coach* (P4)

> *So if the coach is licenced, they have to do regular CPD stuff and the CPD - they have a list of stuff they can do but I think, you know, it has to start within the formal coach education from the beginning as well* (P5)

> *And of course, most coach education is very vertical so, once you've done it, you've done it* (P7)

P6 goes further as to challenge this status quo within their own coaching practice, by questioning why their NGB hasn't evaluated their coaching practice since being qualified:

> *I did my level 3 coaching award back in 2001 and I've been a continual pain in the arse to the coach developer for years about the fact no one has ever come down and said to me, 'let's see you coach.'* (P6)

Furthermore, P4 surmises that coaches don't feel the need to access further sport science knowledge as a result of the paucity of this type of knowledge on the coach qualifications in their sport:

> *It just baffles me as an individual why don't coaches want to learn more and get better and put things into place within sports science? I just don't understand it, and actually it could be down to how the coaching courses are delivered, like the Level 1, 2 and 3, how much input is there actually in those courses about sport science, which I guess is not much* (P4)

Informal Education

Mentoring and Networks

Coaches talked about their coaching mentors - often more experienced coaches, or at least more senior in NGB terms, who supported their development - as being influential in their quest for greater knowledge. In some cases, this was as a direct result of mentors not feeling educated themselves:

In terms of sort of my mentor she, well she is the current national senior national coach … and she actually turned to me and said 'If you get the opportunity to further your knowledge in terms of your education I would highly recommend it' because, basically, she said that that was something that she really wished that she'd have done and that she was lacking, so she was constantly chasing further information and that's what almost helped me to make the decision to go to university (P1)

In addition, some participants talked about the merits of in-house National Governing Body schemes to support coach development through mentoring:

Cycling have got an in-house mentor scheme that any coach can access, any level of pathway and it's free, so I've been fortunate enough that I've done that (P6)

P6 goes on to elaborate on the successes of this in cross-sport sharing of knowledge through effective mentoring schemes:

On the back of it, having done it within Cycling, I actually worked with - it used to be [organisation redacted to limit the possibility of identifying the participant]*, it's now called … - but it's effectively the County Sports Partnership and I offered. They were looking for mentors so I got involved in that process, and I purposely tried to work with coaches away from Cycling and our sister sports so I worked with Basketball, Football and Cricket in the last couple of*

> *years, and acted as a mentor with those coaches ... and then they*
>
> *can use me as a mentor in whichever way they like* (P6)

Whilst mentoring was recognised favourably as an important feature of many participants' knowledge acquisition journey, one participant was quick to acknowledge the potential pitfalls of mentoring to acquire knowledge in sport coaching:

> *Mentoring in sport tends to be, from my experience, about*
>
> *indoctrination, so I would indoctrinate you into how you will do it*
>
> *and mentoring tends to be the person on the pedestal telling the*
>
> *up-and-coming development coach how it should be, which is not*
>
> *mentoring, that's dictatorial, socialisation into a club, and my view*
>
> *of mentoring is if you're going to be a mentor for a coach, it's not*
>
> *about telling, it's about asking questions and it's not about making*
>
> *them do it your way, it's about getting them to do it in a way that*
>
> *works for them* (P8)

Though sport science was not referred to in this part of the conversation, it was felt that it could be safely assumed that sport science knowledge forms part of the broader meaning here, given the main topics of conversation and the focus of the interview.

Although not mentioned by other participants, a network or community of practice was highlighted by P4, who talked about creating opportunities to share whilst developing their own practice:

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I've … just put myself out there and kind of created a network of people. I've been lucky enough to come across some of the best coaches in the Tennis business, you know, who've worked with top professionals so really, I'm kind of supporting them and learning off them and then hoping that it gets to a stage where I will be supporting and travelling with Tennis players and making a living from that (P4)

Blind Faith

Much of the discussion surrounding the acquisition and utility of knowledge centred on the broader construct of culture, either within the sport, within the National Governing Body, or within the profession. More specifically, it was recognised that high-level coaches with a history of success would be followed and replicated without challenging where their knowledge was obtained or under what circumstances they were achieving this success. In addition, some examples were provided of a traditional 'we've always done it this way' mindset. Some nice examples of this came from P2, who mentioned several times during their interview about the culture of their sport reflecting an insular approach to coach development and knowledge acquisition:

I think a lot of coaches - especially the ones that aren't that well educated - are more convinced that they know what's right and what's wrong and, even if the evidence is presented to them, they'd still go, well no, but this is what we do. There's a lot of 'this is what we do because this is what we do' … but I don't think our coaches

> *are, in general, at a place where they could get anything from*
>
> *research* [because of this] (P2)

Furthermore, longer-term consequences of this approach are alluded to by P6 and P8 in discussing the legacy of these more traditional coaches achieving success within their sport adopting these practices:

> *If they're successful with regards to the athletes that do survive that*
> [coaches doing what they have always done] *and come through,*
> *they stay on programme as coaches because ultimately medals get*
> *us money* (P6)

> *Coaches are coming through a coach education system at a Level,*
> *they are not questioning what they are doing, they are replicating*
> *what they've always done and that is still the case today* (P8)

When reflecting on the mindset of coaches within their sport, P3 and P4 identify blind faith in a certain type of expertise being favoured within their sport:

> *I think the barriers that I see are it is very much, okay, so we did this*
> *20 years ago and it worked for me so it must work for you ... that is*
> *what I see in a lot of sports, and talking to a lot of people who use*
> *sport science, you know, maybe younger practitioners that have*
> *come through degrees and come through masters and they're so*
> *passionate about how sport science can help people, help the*
> *athletes and just help people in general, but the challenge is that*

we have all this passion and all this knowledge about it, but then

the coach is like, nah, we don't need it (P4)

I don't know any coaches in this country who access and read

academic literature; I've never come across a single one, and I know

most of them I think … some of it is just in the sort of culture of the

sport and the coaches treat, you know, in Football it's the Mourinho

thing. So, whatever the top-level league coaches are doing, they will

swallow that whole without a moment's thought, which has its own

problems, you know. So, it's not just the expert, it's a certain kind of

expert, or as an expert is perceived to have expertise in a particular

area I think, versus another kind of expert who has expertise in

another area (P3)

[coaches] … are a product of the system that worked for them,

they're not interested in anything different (P8)

This observation is further supported later in the same interview of P3, who goes on to describe how a Head Coach they work with feeds on expert opinion from popular literature (i.e., famous coach autobiographies and other popular media) over academic literature:

…you've got a coach who's pretty well educated, you know, the

head coach of the programme, he's got a degree, got his Level 3,

he's been around the university environment for 10 years plus, but

fundamentally his main influences, if he reads an article, a blog

> *article, written by, you know, Bobby Hurley* [a highly influential
>
> coach in the US] *or whatever, like to him that is gospel* (P3)

Knowledge Translation

Whilst acquisition of knowledge is important, how this knowledge is translated for athlete/coach consumption is of greater importance to this study. Three sub-themes were identified within the broader *knowledge translation* theme, namely *challenges*, *methods of dissemination* and *barriers to implementation,* which were further classified into seven lower order themes: *conceding advantage or control* and *de-jargonising* (challenges), *use of virtual learning environments* and *traditional workshops* (methods of dissemination), and *opportunity*, *research lag and accessibility*, and *casual employment* (barriers to implementation) (see Figure 4).

Challenges

Conceding Advantage and Control

Whilst not true for all coaches participating in this study, many of them talked about a significant barrier to knowledge translation being coaches not wanting to share knowledge for fear that other coaches' athletes would get stronger and start winning more titles/championships etc. In some instances, this was at an organisation level, where certain elite clubs within a sport or the governing body themselves were unwilling to share:

> *…you've got to do everything that you are doing in secret because*
>
> *you don't want to share because somebody else might get better.*
>
> *And that was very much the case with regards to other coaches - it*

> *was very closed; it was very cliquey in terms of - there was this core*
>
> *group of clubs and they didn't let anybody in* (P1)

> *So, you've got a culture that doesn't really want sport science unless*
>
> *it enhances what they're already doing, coupled with a sport that is*
>
> *in some ways very secretive and very protectionist-orientated in*
>
> *terms of any innovation* (P8)

In other cases, this was discussed at the coach-athlete or coach-coach relationship level, where the coach perceived conceding control to the athlete in decision-making as a sign of weakness, and therefore having a reluctance to share knowledge beyond a 'need to know' basis:

> *...most of the coaches who normally coach in Basketball have a real*
>
> *fear of conceding any sort of decision-making to the players,*
>
> *because for them that's a sign of weakness* (P3)

P6, who was an experienced coach in one sport but also a sport administrator in another, highlighted this too, but also elaborated on how some sports are trying to do things differently:

> *So, the Start programme is specifically about putting people into the*
>
> *senior teams. We always tried to get* [Name redacted to limit the possibility of identifying the participant]*, the head coach, so that*
>
> *we could know what he wanted but we'd never get it. Never. So,*
>
> *within the sport, and actually all of us working in the performance*
>
> *bit of sport, people don't share...*

You've just got to work hard and know what you're doing and know what the competition are doing. But in Volleyball, this is within the office and within the sport, we're creating a culture of, this is with [Head Coaches name removed to limit the possibility of identifying the sport or participant] *as well, but we can check and challenge people, we support people in ideas, that everyone has got ideas from the bottom to the top, that there's flexibility. We'll try something, if it doesn't work, we'll know why it didn't work. If it does work, we'll know why it did work* (P6)

De-jargonising

Given observations in a previous section about formal education, and the recognised importance of regular CPD to sport science knowledge acquisition, it came as no surprise that many participants identified jargon/the use of complex language as being a barrier to effective knowledge translation:

There's still a job to do in terms of translating and applying it to your own context, which is another thing that I think a lot of coaches struggle with, as in, unless somebody is actually saying to them - like, so for you and your players right now, you need this (P3)

There's so much jargon ... I think that you can educate coaches and that has definitely worked, you know, trying to promote coaches to go to workshops and attend different courses, that works to a certain extent. But, I think on the flipside, if they don't view that as

their role as a coach then they're not going to necessarily go and do

that (P4)

Methods of Dissemination

Use of Virtual Learning Environments (VLEs)

Though not unanimous, practically all of the participants in this study identified the use of the internet, and specifically virtual learning (online) environments (VLE), to translate and relay knowledge and information to a wider network of coaches.

> *I think we're in a day and age where information can be put online … there can be tools, there can be apps that are developed and things like that. I think there are so many opportunities [where] knowledge can be shared … it's utilising technology to get the message across and also to share the information* (P1)

> *I think ultimately some forms of online resources are the best way to go for coaches really, because, yeah, I just feel if people are going to choose to – if they want to develop and learn they'll use that really. So definitely online, using online resources … you need the skills to work out what is useful, is that relevant? Rather than, you know, is that just someone putting really a video up whose best mate told them to do it, that sort of stuff, that's one of the key things* (P4)

> *I also think there should be a mechanism more forced for people to*
>
> *update, in effect, via e-learning now, whether that is a presentation*
>
> *that you can and access online* (P7)

Traditional Workshops

Given that the majority of National Governing Body coach training currently takes the format of half-, or full-day workshops situated in a classroom or practical environment, it was not surprising that the participants identified such workshops as a means to provide sport science knowledge and applications in the future:

> *It would be advantageous to do things like open workshops where*
>
> *maybe you've got half a day on, I don't know, a needs analysis for*
>
> *a coach where we could actually have a sneak peek at … what this*
>
> *is and for a sport scientist to be there and … work with coaches in a*
>
> *… free and open environment* (P1)

Though several participants suggested a workshop format as a suitable method to convey and disseminate knowledge, the limitations of this approach were also recognised. For example, P2 talked about the familiarity of those attending such workshops:

> *Sadly, it's the same faces each time. So, some will come in - and they*
>
> *come from quite a way, some of them come from like Bristol and*
>
> *Bath, some of them come down from Scotland. So, the people who*
>
> *are engaging are willing to engage properly, and do the travel, and*
>
> *put the miles in, and learn about the research and see what's*

happening, and we can chat about things that are going on. But

there are also coaches who are ten miles down the road who don't

engage and sadly that's the majority of coaches (P2)

P5 also provided a suggestion as to how this format might be made more accessible and useful to coaches:

If you have an annual conference and stuff like that, it's having

things that are practical rather than, you know, going to some

brilliant lectures and presentations, but then it is actually what am

I going to do that? (P5)

Barriers to Implementation

In the authors opinion, a thesis of this kind is only of benefit if barriers to implementation can be established, and viable solutions can be proposed. Whilst a number of potential barriers could be identified in previous categories of interview response previously discussed (for example, blind faith and the quality of NGB coach training programmes), the coaches in this study identified other significant areas that they believed to be potential barriers within their interviews, namely *opportunity*, *research lag and accessibility* and *casual employment* (see Figure 2).

Opportunity

Many of the coaches revealed that the first time they were exposed to sport science was when athletes under their direction were promoted to National squads or when they themselves were recognised as being a progressive and skilled sports coach and

'fast-tracked' into coach development programmes by their NGB. For example, P1 said:

> *I was lucky enough … to have performers get on to national squads,*
> *probably sort of in my early twenties, so I'd say between 10 to 15*
> *years ago, and that's when I realised what elite sport actually was,*
> *in terms of … the support that you get … and that's at the point*
> *where I realised I needed more knowledge* (P1)

Notwithstanding the irony of this, that in many cases coaches and their athletes were able to reach international level without support from sport science practitioners or sport science knowledge, a clear pattern emerged suggesting that this was the case across sports, regardless of whether the sport was amateur or professional, Olympic or not, and that coaches and athletes do not receive exposure to sport science knowledge until a late stage of their development.

Another aspect of opportunity revealed in some cases was the serendipitous nature of the participants elevation to coaching at higher levels:

> *That wasn't because I was like some world class coach or anything;*
> *it was just more right place, right time a lot of it, so I got quite lucky*
> *in that I got opportunities to coach a decent standard quite young*
> *(P3)*

> *That's how you get recognised, by working with an individual and*
> *that could literally be because - how that comes about could be*
> *because your parents are friends with their family or you're their*

brother or sister. It doesn't matter how good you are, it's just being

in the right place at the right time for that individual really and if

they buy into you (P4)

Research Lag and Accessibility

A recurring theme amongst coaches was the observation that a latency between research and its publication existed; that is, the length of time between submitting new research for publication and the date that it is readily available to the scientific and coaching communities. This was most aptly summarised by P6 and P8:

I think the difficulty with research to application is the fact that we

still have that lag. By the time you get published, I suppose it's

moved on two or three years (P6)

One is there's the issue of making current and future research that

emerges available for coaches (P8)

Casual Employment

One barrier to successful implementation of sport science shared by P7, specifically the effective use of performance analysis data, was the seasonal nature of employment within their sport:

I think it's that culture which is prevalent amongst certain coaches,

that in the winter they're paid an hourly rate to deliver age group

[sport redacted to limit the possibility of identifying the

participant]*, so if they do some big analysis outside of the session,*

they're not paid for that so they're not going to do that and that's

where – It's just another, I suppose, example, of where …video

analysis is part of sports science, we have the analyst side and it's

actually programming and working out what's going on, that's

another example where, because they're not full-time, there is a

reluctance in some quarters to do it (P7)

Qualities of Practitioners and Coaches

When asked directly about qualities in practitioners, participants unequivocally

identified preferred features of sport science practitioners, namely *expertise*,

knowledge of the sport and environment, *rapport building* and *humility*. Coaches also

revealed some examples of their peers' practice which would improve the acquisition

and translation of sport science knowledge into their sports, namely an *open mindset*

and *clarity of performance objectives* (Figure 4).

Qualities of Practitioners

Expertise

Though it is probably the least revealing finding in this study, a number of participants

recognised that domain expertise was the most important quality in sport science

practitioners and educators:

I think having the knowledge and the expertise is the prerequisite

to get past the coach, because the coach wouldn't send them [the

athletes] *to just some random person* (P2)

I've been lucky enough to work with some really good practitioners,

and for me it's their expertise. I want an expert, someone who's

passionate about what they do, and interested in who they're

supporting (P5)

…don't try and pretend you know when you don't. I think the big

thing is the old-fashioned phrase, 'know your onions'. I think that's

the big, big one really - you want someone that really knows their

stuff. Obviously, there is an advantage if they understand the game

that they are working in, I think, but the big one for me is knowing

their stuff (P7)

Knowledge of the Sport and Environment

This last quote offers a useful segue into another quality perceived to be important

in practitioners by coaches participating in this study, namely a knowledge of the

sport that they are working within:

The first question you get asked by anybody, and this is players and

coaches alike is, who did you play for, who have you played with.

You know, it's those questions they want to know about … because

that's the thing that they're going to - that is the heuristic that that

they can use to make the shortcut, to make a judgement whether

to listen to you or not. Whether you've got anything (P3)

I guess quite a lot of sports, you need to know about the sport and

you need to be able to play the sport to a certain extent to lead and

deliver (P4)

I think engaging with it, you know, the coaches that you're working

with and, again, I think as a researcher there's nothing worse where

you rock up and the performance director sort of says, yeah, I'll give

you access to athletes and you get in and you speak to the coach on

the grounds and straightaway you can see there's no interest. 'Why

are you taking 20 minutes of my training time? What do you mean

you want to take them off the track and take blood?' So, I think it's,

you know. It's almost that aspect that if you get the buy in and the

coach is passionate, it's going to be so much easier for you (P6)

Additionally, P1 talked about an appreciation of the journey that the coach and athlete have gone on to reach the level they are performing at, and the complimentary understanding of the environment that this requires:

I think … understanding that often, when they come to be involved

with an athlete or program or something like that that, actually,

many years will have happened prior to them being involved and so

it's almost the understanding where those athletes and coaches

have come from… A different approach is needed to each sport so

it's … understanding not only the people that you're working with,

but also the sports and the environment you're working in (P1)

An important category of response that was identified in the *knowledge translation* theme was that of *de-jargonising*, in relation to how coaches could more effectively employ the use of sport science knowledge in their practice. This feature was also recognised by participants from the perspective of qualities sought in practitioners:

the ability to convey and disseminate knowledge into sport-, coach- and athlete-friendly language:

> *If you're going to be an effective Sport Scientist then - actually - it's not just sitting in the lab and coming up with data. It's how you then pass on the information* (P1)

> *You need somebody with a degree of knowledge and expertise about the sport science side of things, to come down to the level - or to meet with the coach in the middle - or maybe to go further towards their end of the spectrum, in terms of the use of the language and everything else and how this is done and then slowly move them, but always through direct contact* (P3)

> *There's no point having research if you're not going to use it, but coaches aren't researchers. They need to know the practical applications of it...* (P5)

This was further elaborated upon by P6, who talked about perceived assumptions made about athlete's and coaches' level of knowledge when working in a high-performance environment:

> *It's very easy to make assumptions about what the athletes know or should know and equally it's - it's very easy for the Performance Director or the Head Coach to make assumptions as to what the coaching staff know or don't know - so I think it's making sure that*

> *they* [the coaches] *have the ability to ask those questions and say,*
>
> *'look, I don't understand what that means'* (P6)

Building Rapport

Of the topics and discussion points raised throughout the course of the interviews for this study, none were as frequently discussed as the recognition that the ability to build rapport with coaches and athletes was integral to successful integration of sport science practitioners into high-performance sport settings. More specifically, participants recognised a lack of this quality as being a limitation:

> *If you've got somebody who is maybe an expert in Biomechanics, it doesn't mean that they're an expert at working with people and that can be a challenge in itself as well because, as coaches, we tend to be experts working with people, and understand the people that we're working with. That can then sometimes breakdown in the way that somebody presents their findings or results, which can have a detrimental effect if it is not managed in the appropriate way …on their degree route is there anything with regards to working with coaches and things like that, or is it completely just scientifically-based?* (P1)

> *I think a lot of it from them* [the coaches] *is personality. So, if they get on. If there's a personality clash, they're never going to do the exercises or whatever it is or the food, so they need to get on* (P2)

A bunch of people who'd got letters after their name, putting complex slides on a screen with graphs and tables and things, all of which is really nice information, feeding it down to people saying this is what you need to know right now, and you need to change your practice because of this, and yeah, after a while coaches - you know, coaches that I know just go 'fuck off'. Ultimately you build up enough trust with the squad and the coaching staff to be able to do that more directly. But I think that takes time (P3)

It doesn't matter who you are. If the player likes you, and you get on with them, and they buy into what you're saying, that's more important than I guess the name. It's all about developing relationships with the players you're working with. If you can develop relationships, and they buy into what you're saying, then that's the key thing … They're going to work hard for someone that they trust and that they respect, and also, I don't want to use the term 'like', but they want to work for, rather than someone who has the best knowledge in the world about that particular sport but they can't buy into what they're saying, how they present themselves (P4)

I think there needs to some work done around, around interpersonal skills and, again, it's a massive part of understanding the people that you are working with (P1)

Recognition of building rapport as an essential quality for sport science practitioners was nicely summarised by P7:

> *Ultimately, the fact is if you don't build a rapport, the player doesn't listen* (P7)

As well as the common observation that rapport building was an essential characteristic of good sport science practitioners, P1 provided a useful anecdote to highlight how important it is to consider the use of data and timing of presenting it to the coaches and athletes as well:

> *I know an athlete that was almost completely Jekyll and Hyde. The Biomechanist had a great relationship with this athlete in a competitive environment and it was an international competition for an Olympic trial. The Biomechanist went … to this elite athlete to give some feedback and information, and basically got told where to go by this athlete, because of the stress within that environment at that event. He didn't need that information there and then at that point and actually it was understanding that - actually - that changes, you know, in terms of that athletes' approach to training and competition all vary* (P1)

Humility

A small sample of coaches in this study shared experiences of circumstances where they felt the sport science practitioner could have displayed a better understanding

of the environment they were entering, with regards to describing a 'protective bubble' around the athlete:

> *…when you start working with Sport Scientists it's very much 'us and them', and there's almost this protective bubble around an athlete and I think it needs to happen much, much earlier in a coaches' journey* (P1)

> *…suddenly, those responsibilities are - appear to be - handed to somebody else, and it's very much, initially, "But I'm the expert in this field so I know better than you', and that can be rather challenging as a coach when, again, it's almost that protective bubble like I described* (P2)

This was interpreted as a suggestion that the quality of humility was a key characteristic of the most successful sport science practitioners.

Qualities in Coaches

When asked about qualities in coaches, and specifically those qualities that would enhance the coach-sport science practitioner relationship, the participants in this study revealed few qualities. However, two notable characteristics of coaches were identified: an *open mindset* and *clarity of performance objectives*.

Open Mindset

How new knowledge can be applied in a performance setting was a recurring theme in the interviews conducted for this study. More specifically, this was discussed by

several participants in relation to the broader concept of an open mindedness to latest ideas, both as a barrier to successful implementation and as a driver to develop:

I think an openness really because … coaches are often quite protective of their athletes and their environments. … it's almost like being frightened of being exposed to not being knowledgeable within a certain area (P1)

It really depends on the individual, so if they're very open-minded, I think they will buy into sport science. I'm lucky that the coaches that I work with, they buy into sport science because they're open-minded and they've had success with it previously … it's that succeeding using sport science that has really helped coaches buy into it. On the flipside I can see coaches that are a little bit more close-minded about it really (P4)

…you've got to have the coaches with an attitude and approach wanting to see and hear that information to use it … Until you get coaches with the right mindset in a club environment or an organisational environment, that is promoting and encouraging those mindsets, you can offer sport science any way that you want, it isn't going to get adopted until you get someone who changes (P8)

A specific example to highlight why an open mind to sport science was provided by P3, who discussed how sport psychology was stigmatised within their sport:

I mean there's a whole other issue about the kind of way that sports psychologists are perceived and used in Basketball, which is a similar story and there isn't a lot of information out there, but - I know some that they - and it's typical that they're seen as some sort of, you know, come and sit on my couch or a coach will say he's got a problem (P3)

Clarity of Performance Objectives

One participant was particularly vocal about their frustrations surrounding the perception that any communication breakdowns between sport science practitioners and coaches were of the practitioners doing. P3 identified coaches' lack of clear strategic direction, in terms of tactical and technical aspects of their sport, as being a limiting factor in the ability of the sport science practitioner to make a difference in a performance setting:

I think if a coach doesn't have a clear performance model it's very, very difficult to attach any of that other stuff in because you can't make the connection between the psychologist, all the psychological preparation, all the fitness preparation, and what the coach is trying to achieve with the players on the court from a tactical and technical perspective. So, where I think … one of the main reasons why a lot of this stuff falls down is because – and it's not the fault of the sports science guys talking in their silly language and everything, it's the fault of the coaches who haven't got a clear enough view of what the hell it is they want on the court (P3)

Though this was not discussed by any other coaches that participated in this study, it revealed an insightful alternative perspective into some of the barriers in communication noted in previous literature and in this study.

International Comparisons

Though gauging expert coaches' views on how coaching systems differed between other nations was not a priority area for this research, it became clear throughout the interviews that the participants in this study used such comparisons to make sense of their own circumstances and to define the culture of sport coaching in the UK. For example, P2 discussed how an NGB in a high-ranking country would not automatically license a coach from the UK (or anywhere else) to work in their country:

> *So, if we turned up and said, 'we've got a Level 3 from …', they would go, 'Okay, so you'd like to learn how to coach' and they'd quite happily teach us, but they wouldn't say, 'Yeah, you're a coach'. They'd go, 'No you need to learn how to coach now'* (P2)

P3 discussed the culture of their sport (Basketball) frequently throughout their interview, making comparisons with the National Basketball Association (NBA in the US), whilst other participants shared their experiences of cross-Atlantic coach education:

> *I'd say the tradition of coaching is very heavily influenced by American collegiate coaches, and American collegiate coaching is very influenced by a sort of military approach to coaching. It is typically, you know, it's the usual bollocking, you know, you throw*

chairs at people in the locker rooms ... they don't all by the way, you know, I do know plenty of coaches who aren't in that kind of mould, but my direct contact with a lot of coaches has been that, and therefore what I've done is I've had to define my philosophy in direct opposition to that which I've come to recognise as just being almost like the antithesis to everything that I believe in (P3)

I have noticed in the US there is a lot more appetite for conferences with regards to sport science in Tennis coaching. I don't know if that's because the population is bigger, but as a general rule there is more appetite for using sport science within Tennis with the coaches (P4)

Finally, P5 shared their experiences of how post-Olympics a country traditionally perceived as being particularly strong in high-performance sport (Australia) have started trying to mirror approaches adopted in the UK:

So, it's [Australia] a very interesting place to be after the [London 2012] *Games because they decided to change the way they do everything. I'm not sure that's working for them. I think they're trying to replicate a more British model, but I don't think it will work in Australia, because also they're so - the states are like little countries in themselves, so I think that's a real plus for them, that they compete against each other so fiercely but they're trying to make it National and that's difficult in Australia. And, you know, it's*

the institutes that run the sports really, not the sports, so it's a very

different culture, whereas here, it's the sports run the sport (P5)

Summary of the Chapter

The results presented in this Chapter offer an insight into some notable trends in conversation during the interviews conducted for this study. Of these, three clear first-order themes were identified, namely *knowledge acquisition*, *knowledge translation* and *qualities of practitioners and coaches*. Coaches acknowledged the value of both formal and informal learning as a means of acquiring new knowledge, whilst also recognising limitations of the latter if not used appropriately and without mediation. Participants also discussed challenges to translation of sport science knowledge, including the well-researched area of complexity of language, whilst noting that both online and traditional learning environments were their preferred methods of receiving new sport science knowledge. Finally, when discussing qualities perceived to be important in practitioners, coaches revealed soft skills such as rapport building and communicating in context as being key to successful integration into high-performance sport settings, at the same time revealing that a more open mindset in their peers was also integral to this success.

Discussion

The primary aim of the first study in this thesis was to understand how expert coaches of athletes and sports teams' access and use sport science knowledge, and to determine any barriers to successful implementation of this knowledge. Surprisingly, given the investment in scientific support by (amongst others) UK Sport and NGBs, limited research exists that has explored these parameters within the context of British sport. As such, the study looked to elaborate on similarly themed research conducted in Canada (Reade et al., 2008a, 2008b; Reade, 2010) and Australia (Williams, 2005) employing loosely structured interviews as a data formulation tool. In acknowledging that sport science knowledge is currently located in the later stages of coach training in the UK (i.e., UKCC Level 3 and above), expert coaches offered the best opportunity to understand the research topic in context. Thematic analysis of transcribed interviews found there to be three (higher) first order themes that were most frequently discussed by the participants; namely *knowledge acquisition*, *knowledge translation*, and *qualities of practitioners and coaches*. Furthermore, an additional seven second order themes were also identified, representing seventeen lower-order themes (see Figure 2).

Knowledge Acquisition

Coaches that participated in the first study identified *undergraduate and postgraduate coach education*, *NGB coach training*, *mentoring and networks,* and *blind faith* as sources of sport science knowledge. These were classified as being either *formal education* or *informal education*, using definitions of learning

environments popularised in sport coaching research by Nelson et al. (2006) and Cushion et al. (2010)

Formal Education

Formal education is learning that is achieved through a standardised curriculum (Nelson et al., 2006), and it is in this format that NGBs deliver coach training in the form of the United Kingdom Coaching Certificate (UKCC) at Levels 1 to 3 in particular. Courses delivered in this way are mostly curriculum-driven, prescriptive by design and predicated on declarative knowledge as the primary knowledge type (e.g., Shay, 2013; Dray et al., 2016; West, 2016). The main advantage of such an approach is in satisfying minimum occupational standards in growing the (predominantly) volunteer sport coaching workforce in the UK, though impact is often described as minimal with limited evidence of transferability or application from such training (Townsend & Cushion, 2017).

The expert coaches in this study identified NGB coach training as a source of sport science knowledge, whilst also sharing their frustrations at the dearth of knowledge, particularly in the 'ologies' (Abraham et al., 2006), contained within this format of coach learning. Findings therefore reinforced previously documented research that recognise the value of formal means of education to develop and maintain knowledge despite reservations pertaining to the quality of both content and approach (e.g., Erickson et al., 2008; Piggott, 2012; Stoszkowski & Collins, 2016; Hedlund et al., 2018; Stodter & Cushion, 2019b). These finding are also in common with other research that has highlighted coaches' concerns with formal training not meeting their individualised knowledge needs (Nash & Sproule, 2009; Piggott, 2012;

Fullagar et al., 2019), as well as the research specifically examining sources of sport science knowledge in British, Portuguese and Turkish sport coaches (e.g., Nelson et al., 2006; Mesquita et al., 2010; Martindale & Nash, 2013; Kilic & Ince, 2015) as well as the work of Williams (2005; Williams & Kendall, 2007a). It could be surmised that much of the participants' sport science knowledge was acquired through educational opportunities separate to their NGB coach training, given their responses to other questions in the interviews related to informal and non-formal learning and preferences, and methods of dissemination.

Notwithstanding this, participants unanimously supported the idea of sport science knowledge being embedded in coach training, supporting the author's contention that sport science should form part of the curriculum at *all* levels of sport coaching. It could be that limited exposure to sport science knowledge in entry level coaching qualifications makes it more difficult for coaches to assimilate and make sense of such knowledge when introduced to it at more advanced levels of coach training, such as UKCC Level 4. The introduction of more sport science content to coach training would necessitate the re-examination of the core knowledge components of entry level coach training, as well as encouraging further discussion around the professional standards of coaching presented by CIMSPA (CIMSPA, 2019), where minimal sport science knowledge is suggested. Failing to do this would present challenges to NGBs and coach developers in terms of duration and cost of coach training, as well as posing a threat to the ability of NGBs to provide coach training given the many social barriers reported in sport coaching (e.g., Thompson et al., 2020).

Though interviews did not discuss at length learning from informal situations that occurred as a result of formal learning, such as the interaction between candidates in refreshment breaks and between study blocks of coach training, it could be hypothesised that such learning does take place when a body of coaches with similar levels of experience and ambition are placed together. This unintended learning has previously been reported by Jones and Allison (2014) and may offer an explanation as to why expert coaches that participated in the present study valued formal learning opportunities despite their other misgivings. Though part of higher education-delivered coach education, the authors own experiences of teaching on the UKCC Level 4 programme at Sheffield Hallam University, particularly when coaches from different sports collaborate and share examples of practice, anecdotally supports the suggestion that this unplanned, accidental, activity is a critical component of the learning that takes place in formal education environments. Despite this, caution should be taken extrapolating this suggestion to less experienced coaches where tacit and experiential knowledge structures have not yet formed (Dreyfus and Dreyfus, 2004). Investment in all forms of learning has also been observed as a critical feature of adaptive experts (e.g., Schempp et al., 2007; Mees et al., 2020), who knowingly seek out opportunities to develop their knowledge in whatever means possible.

Lyle and Cushion (2017; also Cushion et al., 2010) suggest that formal learning approaches offer an NGB the opportunity to indoctrinate candidates into a prescribed way to coach (and therefore apply knowledge), and some evidence in support of this proclamation can be found in the responses provided in the interviews

for this study. In his paper exploring coaches' experiences of formal coach education, Piggott (2012) discussed the irrational activity that takes place within closed circle networks as being a major cause for concern in coach training, primarily owing to the core tenets of knowledge created by those within the circle not being subjected to either scrutiny or criticism. This presents a further problem in the context of the current study, in that most coaches taking coach training will not challenge the curriculum or broader knowledge concepts that are delivered on these courses. Perhaps participants interviewed for this study recognised this flaw in NGB-led coach training when highlighting the importance of formal undergraduate or postgraduate degree-level education as a supplement to coaching qualifications? This finding also echoes the views of Nash and Collins (2006), and more recently Twitchen and Oakley (2019), who advocate a shift in curriculum-based coaching courses from a transmission of declarative knowledge between coach educator/developer and recipients to an approach that adopts a more constructivist approach based on procedural knowledge and greater questioning, facilitation and interaction between candidates and instructor.

Though formal learning in the form of coach training was a source of frustration for many of the coaches, not all participants' experiences of formal learning were negative with one participant describing their experiences of formal coach training in the sport of Volleyball as being receptive to current ideas and learning methods. Similarly, Piggott (2012) highlighted Volleyball as being an example of a sport where attempts have been made to adopt a more liberal philosophy to formal learning. Given the commitment of Sport England (2016, 2021) to reform coach training, it is

refreshing to see that some NGBs have modernised their approaches to coach training and suggests a positive (albeit small) change in how some NGBs are developing their coach certification programmes. Further research examining the differences between instructor-led and participant-led coach training is warranted to determine the impact of such training on coaching practice.

In contrast to other professions, such as nursing and law, there is no requirement for sport coaches to possess degree-level education despite coach education, in the form of undergraduate and postgraduate degrees in sport coaching, being praised for their potential to develop higher-order professional skills such as critical reflection (Dixon et al., 2021), social practices (e.g., Elvira et al., 2017) and decision making (Trudel et al., 2020). Though not specific to sport science knowledge, Stonebridge and Cushion (2018) also recognised significant statistical differences between graduate and non-graduate coaches in their use of divergent questioning, self-awareness behaviours, adapting to contingencies, and use of methods to promote decision-making, when evaluating the impact on graduate sports coaches in professional youth soccer, supporting the contention of participants in this study that education background will influence how coaches use knowledge in practice. As such, it was revealing that participants in this study recognised that degree-level sport coach education, particularly in the scientific disciplines, was an important feature of expert coaching with some participants suggesting that it should be a mandatory requirement for sports coaches.

Much of the literature exploring knowledge acquisition in sport coaching has centred the discussion on dissemination strategies, so a skew towards presenting findings in

'coach-friendly' media as an outcome is inevitable. For example, Williams and Kendall (2007a) and Reade et al. (2008) placed the emphasis on practitioners disseminating findings in a more sport-, athlete- or coach-friendly manner. Though this was still something discussed by the coaches that participated in the present study (see sections on *de-jargonising*, pg. 141 and *knowledge of the sport and environment*, pg. 148 for examples), it was revealing that participants acknowledged the responsibility for knowledge acquisition must also lay within the profession to upskill in areas such as research methods (to read, interpret and apply research findings) and the sport science disciplines.

These findings corroborate the findings of Hedlund et al. (2018) who cite Nelson et al. (2006) in suggesting that many coaches possess limited sport science knowledge, but that key professional knowledge areas such as age-related changes (i.e., maturation and growth, physical and psychological development) and physical literacy should be introduced to entry-level courses specialising in participative sport coaching, whilst topics such as conditioning, periodisation, nutrition and anatomy should be prevalent in performance sport coaching. The ICCE standards (ICCE, 2016) further reinforce the potential impact of degree-level sport coaching education on the expertise and professional development of sports coaches, though it is unclear whether a distinction is made between participation and performance in these standards.

Informal Education

Informal learning describes a process that takes place as a result of complex interactions between personal experience, activity within a professional environment and mentoring, as well as other sources that involve less social

interaction such as the internet, social media, and books (e.g., Cushion et al., 2010; Dray et al., 2016; Blackett et al., 2017). Importantly, though limited participation in formal coach training has been suggested as indicative of discontinued learning in the sport coaching workforce, many critics of coach training in the UK have pointed to the overwhelming evidence supporting continued learning through informal processes (e.g., Cushion et al., 2010; Dray et al., 2016; Lyle & Cushion, 2017; Twitchen & Oakley, 2019), despite this form of learning being difficult to recognise and accredit and identified as being incidental rather than deliberate (Kaur, 2014).

Participants in this study also identified that an informal learning culture was prominent in sport coach training and education within their sports, singling out their own peers as a primary source of informal knowledge. Most notably the coaches referred to blind faith, a mechanism by which coaches would follow the methods of other (often perceived superior or esteemed) coaches and instructors/developers without any evidence to support whether these would work in their own context, as a prevalent approach to acquiring knowledge. Such perspectives support previous research that have examined preferred and actual and sources of knowledge in the UK, Canada, Australia and South Africa (Williams and Kendall, 2007a; Reade et al., 2008a; Piggott, 2012; Stoszkowski & Collins, 2016; Nkala, 2019). It could be argued that this finding suggests a significant barrier to the acquisition and translation of sport science knowledge by sport coaches, with Stoszkowski and Collins (2016) reporting that the coaches in their study were also unable to source contextually relevant knowledge from informal peer learning. Stoszkowski and Collins (2016) surmised that this was due to a lack of a declarative knowledge base to compare and

contrast and most likely leads to either uncritical application, inaccurate interpretation or dismissal of sport science knowledge. It is clear from the responses gathered from participants that much of informal learning is predicated on the immediacy by which knowledge is made available, making it appealing to a workforce where time and work-life balance are perceived as the greatest barriers to progression and development (e.g., Thompson et al., 2020). However, the paucity of sport science knowledge in coach training (particularly in UKCC Levels 1 and 2) make the low levels of sport science knowledge in coaches unsurprising.

As previously discussed in this thesis, caution should be applied to uncritical learning environments where there is increased potential for coaches to attend to the wrong knowledge and/or learning cues (e.g., Cassidy and Rossi, 2006; Nelson et al., 2013), promoting the need to embrace informal learning as part of a wider approach to satisfying coach development needs that includes appropriate provision and application of sport science knowledge. As such, the findings of this study support the contention of Mesquita et al. (2010) that a cultural shift towards constructivist approaches to coach training, that encourage and support experiential and informal learning, is welcomed. In addition, the increased opportunities for critical reflection and situational awareness on offer through FHE-provided coach education suggest the need to re-evaluate the role of educational background in coaches below UKCC Level 4.

Mentoring and networking have been shown to be a valuable approach in supporting professionals in both educational and workplace settings, including nursing, education, and a variety of business-related occupations (Jones et al., 2009), with

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McQuade et al. (2015) promoting mentoring as an effective method to connect theory and practice in sport coaching and to decomplexify coaching in the field. Despite this, recent efforts to explore a formalised coach mentoring programme have emphasised the dangers of such programmes, with observed cultural reproduction emphasising NGB doctrines toward coaching practice (Leeder & Cushion, 2021). Similarly, mentoring by more experienced coaches (in some instances, the participants describing examples of where they have conducted the mentoring themselves) and networking were put forward in this study as being integral to the acquisition of sport science knowledge. Congruent with the observations about closed circle networks by Piggott (2012) and recent work by Leeder and Cushion (2021), one participant in this study likened mentoring to an indoctrination process where experienced coaches adopt mentoring approaches that make their less-experienced mentees disciple-like in their approaches to coaching practice. In contrast, other participants discussed the benefits of mentoring in challenging existing coaching practice and for continued professional development. Cushion et al. (2010) reinforce the almost dichotomous nature of mentoring where indoctrination and effective learning opportunities are on the same continuum, and these findings support that view of mentoring within expert sport coaches that participated in this study.

In contrast to previous research such as He et al. (2018) and Blackett et al. (2017), identifying former experience as an athlete as a both a source of informal learning and an elite sport habitus corresponding to coaching practice allowing high-level athletes to be 'fast-tracked' into sport coaching, experience as an athlete was not

identified by coaches that participated in this study as a source of informal learning. However, given the focus of the interviews on sport science knowledge, rather than knowledge in a broader sense, this finding was not surprising. In addition, participants in this study represented sports that have not reported habits of promoting experienced athletes into high-level coaching positions such as Football (e.g., Blackett et al., 2017). Concerns have been raised about the prejudicial recruitment of coaches based on previous experience as an athlete or player creating a homogenous workforce and limiting the impact of coach training and education (e.g., Blackett et al., 2018), but the data from this study cannot refute this assertion.

A large body of evidence exists, including the findings from this study, that informal learning opportunities play a large part in the development of expertise in sport coaching. However, what is unclear is how this informal learning can be couched in a more structured programme of coach development to foster higher levels of criticality and reflection outside of coach education in the form of sport coaching degrees. It is evident that mentoring, if undertaken properly, provides an opportunity for coaches to connect their learning from formal and informal opportunities to their own situational context and the findings of this study broadly support this, whilst also underlining the problems associated with poor mentoring such as cultural inculcation. Appropriate mentoring may also offer a workable and affordable solution to enhancing existing coach training provision, as might formalised networking arrangements and the adoption of constructivist approaches to formal coach learning. A danger of trying to do this are issues pertaining to sustainability (e.g.,

Abraham and Collins, 2011), though the benefit to sport coaches seemingly outweigh these disadvantages.

Knowledge Translation

Much of the interview conversation surrounding the translation of knowledge highlighted three key areas, namely *challenges*, *methods of disseminating knowledge* and *barriers to implementation*. These were further classified into *conceding advantage or control* and *de-jargonising* (challenges), *use of Virtual Learning Environments* and *traditional workshops* (methods), and *opportunity*, *research lag and accessibility*, and *casual employment* (barriers).

Challenges

Participants in this study identified several scenarios where coaches, fearing a loss of decision-making or control, would not share their methods and strategies with other coaches, their athletes or support staff (cf. Pain and Harwood, 2004, for further discussion). Surprisingly, some of these shared experiences were provided from *within* a sport at National level. In one such example, the Head Coach of a senior Great Britain squad would not divulge their vision/practice with development coaches working with athletes within the same performance pathway. A such, the findings from the current study support the view that coaches in certain sport settings will often avoid sharing of knowledge and practice at the (potential) expense of other coaches and athletes within same-sport systems as well as more broadly across sports. A recent exploration of coaches' uses of questioning in their approach to coaching by Cope et al. (2016) revealed similar findings, in that they identified that coaches wanted to control access to information, making other coaches and athletes

'passive recipients' in the learning process. Whilst Cope et al. (2016) was focused on youth footballers, and the participants in the present study were all coaches of young adult and adult performers, it does present some interesting challenges to those responsible for sharing of practice in large sports organisations such as National Governing Bodies.

Given the broad range of backgrounds that the participants in this study came from, and the levels of success that these sports have had at winning major titles and medals at a global level, it could be postulated that one conspicuous area of improvement in sport coaching may therefore be around the sharing of practice. The observation that sharing of knowledge doesn't take place conflicts with much of the research examining the important features of successful sport, such as Oakley and Green (2001) and De Bosscher et al. (2008), who identified transparency and clarity within an excellence culture as being integral to sustained success at the highest levels of sport. In addition, although only on a small scale, evidence exists that communities of practice as a method to share best practice can be successful in sport (e.g., Culver et al., 2009; Garner & Hill, 2017; Scott & Whittaker, 2021). Whilst these studies focused more on pedagogical aspects of sharing practice, and subsequent observed improvements in coaches' intrapersonal and interpersonal knowledge, it is proposed that this would be equally effective in developing better sport science knowledge too considering the interrelated nature of coaching knowledge (Côté & Gilbert, 2009), though consideration is needed as to how these communities are developed, facilitated and sustained (Stodter & Cushion,. 2017; Scott & Whittaker, 2021).

A further challenge in translating knowledge was identified as being the complex language used in the sport sciences. Further reinforcing previous discussion surrounding the value of undergraduate and postgraduate-level education in sport coaching, a consensus regarding the overuse (and suggested avoidance) of terminology and jargon was consistent amongst participants in this study. Martindale and Nash (2013) identified language and access as two of three primary concerns when discussing coaches' perception of sport science, citing these as reasons why coaches may choose to disengage from sport science research as well as to gravitate towards informal methods of learning where possible. Of note in this work was the suggestion that the sport science knowledge embedded into coach education curriculum was too late, owing to the perception that coaches did not believe that sport science was relevant to lower-level coaches and those that coach at a participatory level. Based on the evidence presented in this thesis, this is not the case; participants suggested that the introduction of such knowledge, and methods to facilitate effective application in practice, were necessary at *all* stages of coach education including entry-level coach certification such as UKCC Levels 1 and 2.

Methods of Dissemination

Once of the most discussed topics during the interviews conducted for this study was the advantages of using online platforms (virtual learning environments, VLE) to share latest ideas, information, and best practice around sport science topics. When questioned on opportunities for knowledge acquisition and translation, it was clear that participants viewed digital learning, in the form of online workshops and use of a VLE as an opportunity that was yet to be fully exploited. Although recent global

events (i.e., the COVID-19 pandemic), have led to many organisations adopting an online model of delivery for some aspects of their coach training and education (for example, safeguarding), at the time of the interviews this was not the case. Many participants highlighted these platforms as a way of negating the reasons why coaches do not engage with continued professional development (CPD), such as cost and time, though they also recognised that (for many coaches in their sports) it would make no difference. Although these expert coaches questioned why their peers would not choose to engage in learning that would make them better coaches, they also acknowledged that coaches are under no obligation to undertake additional learning and CPD upon certification.

This is not a novel observation or finding by any means, with Stoszkowski and Collins (2016) also identifying the internet as being one of the informal learning opportunities identified in their sample of Football coaches, though this formed part of a larger 'umbrella' theme in their research and was conducted at a time when there were scarce opportunities for coaches to engage in formal and facilitated informal digital learning. Digital learning has also been identified as a means to make coach development more accessible and affordable as part of the Future of Coaching Strategy (UK Coaching, 2017) and Coaching Plan for England (Sport England, 2016), though empirical research examining engagement in online learning yields mixed results in both sport coaching (e.g., Oakley and Twitchen, 2018) and in other areas through Massive Open Online Courses (MOOCs; Perna et al., 2014; Deng, Benckendorff and Gannaway, 2000).

In their study examining the use of online sport psychology resources, Pope et al. (2015) reported the concerns raised by the coaches in their study around credibility of such sources, whilst also stating that coaches would spend more time accessing reputable digital resources if they were made available. Of particular significance to the findings of this study, given the sample of coaches interviewed and their level of expertise, Pope et al. also observed differences between expert and developmental/novice coaches in their use of online resources, providing tentative support for the notion that a ceiling exists between entry-level coaches (defined as novice, advanced beginner or competent by Dreyfus & Dreyfus, 2004) and experts when it comes to accessing sport science knowledge (Williams & Kendall, 2007a; Reade et al., 2008a).

When exploring the topic of online delivery in more detail, participants revealed self-paced delivery and self-selection of topic areas as being the main benefits of this method of delivering coach education, a theme that resonates throughout the literature examining differences between novices and expert coaches (e.g., Potrac et al., 2012; Nash et al., 2017) and in the literature exploring professional development in other vocations such as nursing (Benner, 2004) and accountancy (Kuhlmann & Ardichvili, 2015), as well as part of a more contemporary reimagination of expertise (Berry, 2020).

Despite the overwhelming support for online platforms as an approach to disseminating coach education, participants also proposed more traditional methods for knowledge translation. That is, the use of more conventional workshops, usually in a classroom-type format, delivered by a higher-level coach, coach educator or

sport science practitioner. Given that the majority of coach education to-date has been provided in this format, it is not a surprise that these findings offer further support to earlier research into this area (Williams and Kendall, 2007a; Erickson et al., 2008; Reade et al., 2008) around the use of traditional methods of coach training and education delivery.

What was evident in the interviews was that participants were extolling the *potential* of traditional delivery formats such workshops, rather than focusing on their own experiences of past delivery which were consistent with previous literature criticising such delivery (e.g., Cushion et al., 2010, Twitchen & Oakley, 2019). That is to say, despite reservations about the quality of formal coach training in their own sports, and a clear trend purporting to limitations of such experiences to-date, participants were still willing to invest time and effort in this type of learning opportunity if it satisfied their professional development needs. It could be speculated that much of this enthusiasm stemmed from participants alternative experiences of other learning environments such as further and higher education, where constructivist approaches are adopted in classroom-style learning and (as such) appetite for learning is better facilitated as an individualised and socially constructed entity. As previously discussed, a significant body of research argues for a reform of coach training to better utilise such constructivist approaches (Cushion et al., 2010; Twitchen and Oakley, 2019) where learning takes place through shared knowledge, meaning and understanding (e.g., Ciampolini et al., 2014; Paquette et al., 2018a) and goes further as to make recommendations on how NGBs could implement these approaches more effectively (e.g., Paquette & Trudel, 2018b).

A clear pattern emerges surrounding the differences between adaptive experts (such as the participants of this first study) and routine experts in their appetite for knowledge, whether in the sport sciences or other forms of professional, intrapersonal or interpersonal knowledge (Berry, 2020). Specifically, a pattern of seeking out opportunities to learn was exhibited in these expert coaches, regardless of format. This trend further reinforces the importance of integrating sport science knowledge into lower levels of coach training, since many coaches will not reach expert level (as measured by achieving Level 3 UKCC or equivalent status), where the majority of sport science knowledge is located. Furthermore, as online coach training and education become more evolved, future research may want to explore how coaches engage with these materials and the benefits and limitations of such an approach when compared with more traditional approaches In particular, this research may want to explore the impact on learning as a result of the removal of informal learning that often accompanies classroom-based coach training and education (e.g., Jones & Allison, 2014).

Barriers to Implementation

An interesting finding in the present study was how opportunity played a part in when, how, and crucially if, coaches were able to access sport science knowledge, in that some of the participants revealed that they only received access to this knowledge once their athletes had reached international competition and/or were selected for representative squads at a national level. In one instance, the club structure within the sport was referred to as an additional barrier, since only clubs

with pedigree at producing international-standard athletes were deemed suitable for exposing coaches to continued professional development opportunities.

Given the observation that coaches' dispositions and philosophies of practice are often stable structures that are difficult to change (Cope et al., 2016; Leeder et al., 2021; Webb & Leeder, 2021), it is concerning to think that a coaches first exposure to the sport sciences is *after* they have already evolved as a coach (notwithstanding the irony that athletes have reached this level of performance without the input of sport science). Given recognition earlier in this thesis that the amount of sport science content on coaching courses is small, particularly at the lower levels, it could be inferred that much of the scepticism surrounding sport science by coaches (though not those participating in this study) is as a direct result of a lack of opportunity to be informed rather than any other reasons.

Despite the findings of this study suggesting a requirement for advanced levels of education for sports coaches in the form of degree-level study, accessibility was still found to be a barrier to implementation of current ideas and theories from the sport sciences. Previous research (Williams and Kendall, 2007a; Reade et al., 2008; Martindale and Nash, 2013) have highlighted access as being a barrier to knowledge acquisition and translation in the sport sciences. That is, coaches are often unable to make effective use of the latest knowledge and research findings because of the paywalls in place for many research publications, and that coaches do not (or are unable to) access this information even when readily available (Reade et al., 2008). Furthermore, it is often put forward that an additional barrier is that there is little incentive for researchers to republish their findings in more accessible, more

digestible formats such as technical coaching publications, internet blogs and podcasts (Reade et al., 2008). Expert coaches interviewed for this study substantiated these observations consistently.

The notion of a research lag was also mentioned, with the time between research being conducted and being published recognised as a significant barrier to coaches keeping up to date by reading and understanding peer-review research. Regardless of this, participants questioned whether their peers would engage in this type of knowledge acquisition with the consensus being that sport coaches do not want to have to understand research, published in peer-review journals and often with limited contextual relevance, and would rather receive knowledge that was situationally relevant and shared in a more coach-friendly manner. As previously discussed, digital learning formats were proposed as an effective means to translate and share new knowledge if the source was credible.

A surprising finding in the present study was that of the challenges associated with casual employment in some sports. That is, even at higher levels of sport, there are still significant numbers of coaches employed at an expert level who are employed on a casual basis. Although the participant that highlighted this also articulated that they did not see this as a barrier themselves, noting that those serious about pursuing a full-time career in sport coaching should do their best to devote time and energy to it outside of paid work (consistent with features of an adaptive expert; Mees et al., 2020), it does highlight a prevailing challenge to National Governing Bodies and those responsible for the deployment and continued professional development of coaches. As recently as 2019, North et al. highlight the downplaying of policy developments

surrounding professionalisation of coaching, suggesting that there is some way to go before sport coaching is a fully professionalised endeavour, so this finding should be considered within this context. Whilst well-funded sports afford to appoint full-time coaches across development and performance athlete pathways many sports do not, and this finding correlates with the assertion that coaches do not (and in many cases, cannot/will not) engage in continued professional development, regardless of how much consideration goes into access, cost, and opportunity.

Findings from this study support previous research, such as Williams and Kendall (2007a), Reade et al. (2008), Martindale and Nash (2012) and Stoszkowski and Collins (2016), who suggest that translation of sport science knowledge into relatable, contextualised content is crucial in effective dissemination and application. It would be difficult to argue that much still needs to be done to make this the case in UK sport coach training and education across sports. Participants identified complexity of language, format of publication/delivery and time (in the form of casual employment) as all being reasons for why coaches may not choose to engage with sport science knowledge. It is suggested that the adoption of more constructivist approaches to learning may reduce the impact of these barriers to implementation, whilst participants also agreed that there is a place for traditional (i.e., classroom) and more contemporary (i.e., online) methods of dissemination in any future improvements to coach development.

Qualities of Practitioners and Coaches

Consistent with the previous literature examining preferred characteristics of coaches and practitioners (e.g., Williams and Kendall, 2007a), this study identified

several qualities that coaches suggested were important in those providing training in the sport sciences, whether as a Coach Developer or as a practitioner working with coaches on sport science-related areas. The most widely discussed were those of *expertise*, *knowledge of the sport and environment*, *building rapport* and *humility*. Though this study did not explore practitioners preferred or suggested qualities in coaches (cf. Williams and Kendall, 2007a), it did ask the participants in the study what sort of qualities might be useful in coaches to enhance the translation of sport science knowledge into day-to-day practice. An *open mindset* and *clarity of performance objectives* were those identified.

Qualities of Practitioners

In identifying expertise as being a key quality, the findings of this study extend previous attempts to explore coaches' preferred qualities in sport science practitioners. Neither Martindale and Nash (2013), Williams and Kendall (2007a) or Reade et al. (2008) identified level of expertise as a key feature of good practitioners in their studies exploring similar parameters. Rather, these studies reinforced the importance of simplifying the complexity of sport science knowledge through practitioner training and the embedding of more soft skill development into formal sport science training and education. That does not mean to imply that these studies did not recognise the importance of appropriately qualified practitioners, rather that the outcomes of their research were that the practitioner should be encouraged to decomplexify research findings for sports coaches

It is worth recognising that most of the coaches that participated in Martindale and Nash (2013) were from the sports of Football (Soccer) and Rugby League, where most

high-level coaching positions are filled by ex-players who have come through performance systems where early career choices involve minimising all other distraction (including education) to pursue a full-time playing career. An example of this can be found in Schmidt et al. (2017), who explored the trade-off between education and a professional sports career in Bundesliga Football Academy players and found that cultural integration played a key part in the decisions that these players made. In other words, it was deemed acceptable within the sport of Football to focus solely on their sport and to leave education. The authors own professional experiences of working in professional and semi-professional Rugby League also support this observation, as do the findings of Blackett et al. (2017; 2018) who report an incongruence between playing experience and expectations regarding coaching proficiency. Though participants in the studies by Williams and Kendall (2007a) and Reade et al. (2008) were from a wider range of individual and team sports than Martindale and Nash (2013), it does highlight the importance of looking at individual sports and their coaches at a more local (governing body) level when determining the best course of action for satisfying coach education and CPD needs, especially where specialised expertise of the sport scientist is required.

Participants in this study also discussed extensively the importance of practitioners possessing a *knowledge of the sport and environment* within which fellow coaches and athletes were trying to succeed. Participants alluded to the importance of understanding the audience, valuing (and not undermining) the coach-athlete relationship and ensuring that strategies for dissemination of findings (both research and applied) were carefully considered in the context within which they were

working, a feature of expertise in Dreyfus' work on professional development (Dreyfus and Dreyfus, 2004) This finding is consistent with the research examining the perceptions of sport science in UK-based sport coaches by Martindale and Nash (2013), who reported that a possible explanation for poor transfer of sport science knowledge to coaching maybe a lack of contextual translation or limited time around coaches and athletes in an informal setting. Furthermore, the findings also echo previous discussion in this thesis regarding accessibility of content and the need for applied research to be published through alternative formats despite the 'publish or peril' environment within higher education where most research is conducted.

Relationship building skills are often highlighted as being valued and important in sport science researchers and practitioners (Haff, 2010). This study was no different, with *building rapport* and *humility* cited by participants as being highly valued in sport scientists. In an editorial for the *International Journal of Sports Physiology and Performance* aptly titled 'Sport Science: Progress, Hubris and Humility', Foster (2019) sums up these attributes in sport scientists when he observes that 'In essence, sport scientists should always remember that they are about as important as a good video camera, which helps the coach 'see' their athlete better' (pg. 141). Similar to Reade et al. (2008), who cautiously distanced themselves from such a suggestion, Foster also warns against the assumption by many sport scientists that coaches are poorly educated, rather highlighting the need for sport scientists to use more descriptive language in their dissemination and application of findings to make them more directly applicable to sport settings.

The suggestion in this study, that an appropriate mix of expertise in the subject area and softer skills, such as rapport building, are required for effective sport science knowledge translation highlights an interesting parallel with other professional vocations such as medicine and nursing where a distinction is often made between competency and professionalism. Specifically, whilst it is often considered to be competency in technical and non-technical knowledge and skills (knowing and doing), professionalism should be viewed as a broader term for a combination of behaviours and competencies across a much more diverse range of skills, attributes and responsibilities, including honesty, confidentiality and 'bedside manner' (Matveevskii, Moore and Samuels, 2012). This resonates with theories of adaptive expertise (Berry, 2020) and models of professional development (e.g., Dreyfus and Dreyfus, 2004), as well as supporting the central tenet of professional development literature related to the role of intrapersonal knowledge in success.

Supplemental to this observation lies in the work of Stodter and Cushion (2019a), who observed that coach developers' training was largely based on generic frameworks of learning that did not dedicate sufficient time and resource to facilitating a better understanding of constructivist (i.e., learner-centred) approaches to learning, describing an 'epistemological gap' (pg. 313) between learning theories that coach developers championed and what was observed in-practice by the researchers. Similarly, entry level sport science education (in the form of undergraduate sport science degrees) has little in the way of learning theory as part of its curriculum, with an emphasis on the declarative knowledge of the 'ologies (Malone et al., 2019; Alfano and Collins, 2021) rather than the application of this

knowledge. As such, it could be argued that current education of both Coach Developers and Sport Scientists is largely inadequate in preparing practitioners for their roles in coach training and education, whether by design (Coach Developers) or default (Sport Scientists).

Importantly, whilst frameworks such as the International Coach Developer Framework (ICCE, 2014) recognise the role of the coach developer as being broader than just a transmitter of knowledge, findings from this study suggest that important aspects of the role related to facilitation and lifelong learning have not permeated coach training and education in the UKs coach development workforce at the time of writing this thesis. In championing constructivism in coach development, Dempsey et al. (2021) observe that confusion lay between those responsible for the development of learning strategy at a policy level and how this strategy is implemented through NGB coach training. Though this work was focused on a specific NGB (the Football Association), it could be surmised that similar such incongruence exists between other NGB policy makers and their coach development workforces based on the findings of this study.

Participants in this study perceived that most of the practitioners they worked with were predominantly recent graduates with limited experience in the field (most likely due to the cost of services and the lower salaries on offer in many of these positions). Given that it takes upwards of five years or more in-service before those in the medical professions are 'proficient' (Frank et al., 2010), it is unsurprising that similar observations surrounding limited soft skills in inexperienced sport science practitioners were made. It could therefore be inferred that one of the biggest

challenges to successful implementation of sport science knowledge in UK coaching is the absence of suitable soft skills in newly qualified sport science practitioners. A prevailing observation throughout this thesis is that a ceiling exists between levels of sport coaches, regardless of athlete or team performance, between UKCC Levels 1 and 2 (or equivalent) and UKCC Level 3 and above. Supporting the contention of Kuhlmann and Ardichvili (2015), who propose that competent professionals (i.e., routine experts) will focus on developing routines to manage day-to-day activities rather than seek out news methods and strategies, the findings of this thesis broadly support this view in relation to those responsible for the dissemination of sport science knowledge to coaches as well.

Recent efforts to promote conversation about the development of these skills in sport science and strength and conditioning graduates through internships and other work-based learning opportunities highlight these concerns (Malone, 2017; Desai & Seaholme, 2018). Whilst noting with caution how internships can often be used exploitatively by sports teams to get access to free labour for menial tasks, such as data entry and filming of matches, Malone (2017) discussed the value of internships to both students and the organisation, specifically noting the improvement in soft skills that take place as a result of these experiences (see Sleap & Read, 2006, for further discussion). Furthermore, using Dorgo's (2009) classifications of foundational and applied practical knowledge, Desai and Seaholme (2018) identified skills acquired and developed through sport science internships in the field of strength and conditioning, concluding that opportunities for interns to reflect on the effectiveness of their practices in-situ led to improvements in soft skills. Further work is needed to

examine the efficacy of greater integration of soft skill development into undergraduate and postgraduate sport science degrees, since these commentaries specifically examine internships as a co-curricular concept.

Qualities of Coaches

Though the focus of the interviews was on how coaches accessed and used sport science knowledge in their practice, and the ensuing discussions surrounding how this could be improved, the participants were also mindful of this development being one-sided and did not focus solely on how sport science practitioners needed to change. Participants recognised that coaches needed to possess both an *open mindset* and a *clarity of performance objectives* to enable smooth knowledge translation into practice.

In recognising the need for an open mindset, the participants in this study identified an often-overlooked aspect of professional practice, namely self-awareness (Cassidy et al*.,* 2009; Gilbert & Côté, 2013). It could be interpreted that, in recognising the need for coaches to possess this attribute, many coaches within the sports represented by the interviewees did not have an open mind toward sport science knowledge and its application. Indeed, it suggests that an open mind toward *all* coach education is required to further enhance the acquisition and translation of knowledge, regardless of topic or discipline. Evidence for the mediating features of openness to latest information is clearly articulated in the work of Stodter (e.g., Stodter, 2014; Stodter & Cushion, 2017). It could be argued that this, along with the latent impact of sport science knowledge not being introduced to coach training until

later stages of a coaches' development, are the biggest barriers to acceptance and application of sport science knowledge by sport coaches.

Downham and Cushion (2020) recognise self-awareness as being an essential component of the broader aspect of reflection and reflective practice. Inextricably linked with coach education and coach development, they suggest that reflection in coach development is uncritical and accepted because it is 'good' for coaches (pg. 347). They go further as to suggesting that most coach development returns to a more comfortable position of reinforcing current practice, a theme consistent with the findings of Stodter and Cushion (2019a) and the research regarding conceding control (pg. 139 and 171) and a preference for informal methods of learning, as well as the broad theme running through this thesis related to a ceiling on knowledge and level of professional development in both sport science and sport coaching training and education.

Though only discussed at length by one participant, the assertion that many coaches of high-achieving teams base their coaching on a game-by-game, 'whatever suits the opponent' approach is an important consideration when also taking the authors own experiences as a practitioner in a high-performance environment into consideration. Having spent more than twenty years working in and around national level amateur, semi-professional and professional sport, as a sport scientist and strength and conditioning coach, much of the motivation for this area of research was the authors frustrations with coaches focusing too much on short-term measures of performance gain, rather than on medium- to longer-term approaches to athlete development. This follows a similar thread to that proposed by Jones and Allison (2014) when

discussing the insecurities of their elite level coaches, and the tendency to gravitate toward 'quick fixes' rather than longer-term development needs of athletes and teams.

A worthwhile discussion, and reinforcing this position, is one notable commentary suggesting that many coaches, even at the highest level, do not possess a clear set of performance parameters (Wulf, 2012). Though specifically related to research exploring motor learning and skill acquisition, Wulf (2012) makes some acerbic comments regarding how much useful input a coach can have in the development of research questions and studies, ascertaining that the biggest barrier to successful collaboration between coach and researcher/practitioner is the observation that many coaches do not possess a clear personal coaching model. Furthermore, Wulf suggests that a coach's early involvement in the development of research questions would likely lead to immediate performance gains, rather than longer-term and sustainable success. Wulf does not dismiss the contribution of the coach completely, rather she suggests that the coaches' role should be as an 'active bystander', promoting discussion and challenging practice.

Summary of the Chapter

The first study discussed in this thesis aimed to develop a better understanding of expert coaches' views on access, use and barriers to implementation of sport science knowledge adopting an interpretivist approach. In recognising that most sport science knowledge is introduced at higher levels of coach training in the UK, it was felt that interviews with these coaches would reveal insight that generate ideas as to how access and understanding of sport science knowledge could permeate all levels

of sport coach. What is evident, based on the findings of this study, is that both formal and informal education form an integral part of the knowledge acquisition process for sports coaches in the UK, though the extent to which this knowledge is successfully transferred into the workplace domain is tentative if at all.

Consistent with the extant literature, participants were unanimous in suggesting the use of formal learning as means to develop sport science knowledge, whilst acknowledging the inadequacies in existing coach training in this area. It is proposed that these expert coaches identified formal learning as they could see the potential impact of this type of learning if delivered correctly, in accordance with the literature lobbying for more constructivist (i.e., learner-centred) approaches to be adopted by NGBs (e.g., Twitchen and Oakley, 2019). There was also widespread recognition that many sport coaches in the participants' sports did not want to engage with formal education and would rather rely on informal learning, such as peer learning, networking and mentoring to further their knowledge, despite misgivings as to the credibility of such sources with regards to sport science. Given the widespread recognition that sport coaching knowledge development involves a combination of formal, informal, and non-formal learning, it is recommended that discussion surrounding the licensing and validation of coaching awards involves further debate as to how informal learning can be recognised and accredited (e.g., Dray et al., 2016). This thesis also recognises that there are NGBs who are already adopting more liberal approaches to coach training and education, and that the educational background and expert status of the participants affected some of the findings.

The findings of this study support a well-publicised consensus that, despite some notable (and often historical) challenges and barriers, there is an appetite in expert sport coaches to make better use of the sport science knowledge available to them using a combination of online and physical learning environments (e.g., Stoszkowski and Collins, 2016). In recognising this, more needs to be done to simplify and demystify language, minimise lag between completion of research and publication, and introduce sport science knowledge and concepts to earlier stages of a coaches' learning journey. Of particular significance is the acknowledgement by participants that degree-level education should be a requirement, at least for those coaches aspiring to reach expert status at UKCC Level 3 and above.

Participants in this study agreed that the location of sport science knowledge in NGB coach training was too late, with the majority coming at higher levels (i.e., Level 3 and beyond). Though time is limited on entry-level coach certification training courses (i.e., UKCC Levels 1 and 2), it is proposed that additional relevant sport science knowledge is introduced to the curricula. This may involve distinguishing between target populations, as set out on the ISCF and ESCF, since different curricula would be required dependent on whether coaching was aimed toward participation or performance athletes. An educational framework such as that proposed by Hedlund et al. (2018) may offer insight into how this could be achieved. The development of communities of practice to facilitate this population-specific knowledge may reduce cost whilst fostering a deeper sense of belonging for the course candidates (e.g., Garner & Hill, 2017).

An unexpected finding that has emerged from this study are the common features described by participants in their interviews revealing features of adaptive expertise (e.g., Mees et al., 2020). That is, these participants exhibit agility in determining their knowledge needs, and seek out opportunities to learn from any situation that presents itself (Schempp et al., 2006). Much of the interview discussion highlighted unique differences between these expert coaches and other coaches within their sports, but perhaps provides explanation for the consensus reached between participants, despite their varying backgrounds and sports, and the described malaise towards sport science knowledge and CPD prevalent in much of the UK sport coaching workforce.

Following the work of Williams (2005, Williams and Kendall, 2007a), Reade and colleagues (2008a), Martindale and Nash (2013), and Kilic and Ince (2015) in Australian, Canadian, British and Turkish coaches respectively, this study provides further evidence of the view that relationship building, a key component in constructivist approaches to learning (e.g., Cushion et al., 2010) and the establishment of trust in practitioner-coach relationships (e.g., Alfano and Collins, 2021), is a crucial aspect of effective application of sport science knowledge either by or with sport coaches. In recognising the specific traits of rapport building and humility in practitioners, this study reinforces the importance of soft skill development in sport science education and entry-level positions. Similarly, it is proposed that additional work is needed to ensure that current policy surrounding the use of more contemporary learning strategies by coach developers is applied.

A tentative suggestion in this thesis is that a ceiling exists in proficiency level of both sport coaches and sport science practitioners/coach developers, and that discussions surrounding this observation will need to feature in any reforms of coach education taking place in the UK.

Limitations

Coleman (2019) puts forward a number of limitations associated with the selection and deselection of suitable participants for interviewing. Of these, *access to appropriate participants*, *capturing the interview*, and the *interviewer-interviewee relationship* will be discussed in relation to this study.

Access to Appropriate Participants

The biggest challenge in this research was the trade-off between an adequate inclusion criterion and recruiting sufficient participants to make the study worthwhile and meaningful. Part of the reason for redefining expertise was to cater for the difficulty in recruiting sport coaches of a high-enough level, but this criterion may have also skewed the sample. For example, the desire and expectation for coaches to possess degree-level qualifications may have been observed in this sample as a result of the modified inclusion criteria employed. In addition, though it was decided *a priori* that interviews would be conducted to a point of saturation (see pg. 124 for further discussion), the number of available participants interviewed makes the sample size small, even for a piece of research of this kind.

Capturing the Interview

Morgan et al. (2016, cited in Coleman, 2019) acknowledge geographical location as a potential barrier to successful use of interviewing as a data gathering technique. Owing to the location of the participants for this study, a combination of physical and telephone interviews was conducted. As a result, only verbal data was collected and analysed. It was felt that the length of the interview, and the probing around salient points throughout, would minimise the impact of only recording verbal responses, but it cannot be discounted that non-verbal responses may have offered an alternative insight into some of the discussions that took place.

Interviewer-Interviewee Relationship

Probably the biggest challenge associated with interviewing is the effect of the relationship between the interviewer and interviewee on the research process. A variety of distinctive characteristics of both parties may influence this, including age, sex, ethnicity, and any pre-existing relationships between the interviewer and respondent (Mann, 2011). In conducting longer interviews, the author spent considerable time at the beginning of each interview building rapport through sharing of stories and mutual experiences to balance any power asymmetries or inequality that may have been perceived (Mears, 2017). In addition, participants were also given the opportunity to revise and comment on the interview transcripts to minimise this effect (Torrance, 2012).

Other Limitations

It is worth noting that all the coaches interviewed for this study were at a minimum qualified to undergraduate degree level, many with master's degrees in related subjects. Though this may be reflective of certain areas of the full-time UK coaching workforce, some of the responses from the participants could be accounted for by this.

Study #2: Sport Science Knowledge in the Coaching Curriculum

Context

The first study in this thesis explored expert coaches' views on sport science knowledge and looked to establish a better understanding of where and how they accessed sport science knowledge, whether they perceived sport science knowledge to be of value to their practice, and to identify any potential barriers to knowledge acquisition and translation. Consensus was consistent with previous literature that coaches acquired sport science knowledge from a variety of formal, informal and non-formal sources, though indifference towards the level of contextual relevance to knowledge acquired through formal coach education was observed in many cases. Demonstrating features of adaptive expertise, participants could see value in all sources of knowledge but that there were a number of barriers that may prevent coaches from being able to access, understand and/or make effective use of sport science knowledge in their day-to-day practice.

One of the hypotheses generated from the first study was that the location of sport science knowledge in NGB coach training was too late. Specifically, it was suggested that the paucity of sport science knowledge in entry-level (i.e., UKCC Levels 1 and 2) coach training may act as a barrier to coaches effectively using this knowledge as they develop. A by-product of this late introduction is that coaches do not possess a declarative knowledge base to foster meaningful, evidence-informed discussions in informal learning contexts, recognised as being both a powerful and preferred method to acquire new knowledge by both participants of the first study and within the extant literature (e.g., Williams & Kendall, 2007a; Reade et al., 2008a, Martindale

& Nash, 2012; Stoszkowski & Collins, 2016; Kilic and Ince, 2015).As such, to locate this research in the author's professional domain, as a developer of sport coaching curriculum in a higher education setting, a further study was warranted specifically examining the perceptions of the coaching workforce with regards to the whereabouts of sport science knowledge in relation to coach training and education. Specifically, the primary aim of this second study was to explore what sport science topics coaches considered valuable and important, and the preferred location of this knowledge in the coach education curriculum. In addition, given the recognition of further and higher education background and continued professional development opportunities by the participants in the first study, a secondary aim was to establish coaches' views on the role and function that further and higher education, National Governing Bodies of sport (NGBs), and Continued Professional Development (CPD) play in coach learning, education, and development.

Methods

Permission to conduct the study

Ethical approval was received for the study from the College of Health, Wellbeing and Life Sciences Ethics Committee at Sheffield Hallam University (Appendix D). Since techniques used were non-invasive, and the line of questioning was not considered to be emotionally or psychologically upsetting, procedures were deemed minor regarding risk.

Study Population and Sampling

Sports coaches (n=44) were recruited through a variety of methods, including closed professional networks and social media, namely Twitter, LinkedIn and Facebook, and invited to complete an online survey using Google Forms (Appendix E), a free online survey and data collection tool. Though there are recognised limitations of using these networks for recruiting (e.g., Stokes et al., 2019), the advantages include speed of recruitment, cost efficiency, and snowballing effects. Several additional professional avenues were explored as part of the participant recruitment process, including contact with undergraduate and postgraduate students, colleagues actively coaching, and coaches from local and regional sports clubs known to the author.

Cesare et al. (2018) suggest that online sampling and data collection offer researchers the opportunity to broaden a study population beyond traditional networks and word-of-mouth. However, to offset concerns about whether online sampling methods truly represent the general population, this study employed an anonymity strategy recommended by Feehan and Cobb (2019). As such, participants were

invited to complete the survey without any specific information that would allow the researcher to identify them (though participants were offered the opportunity to share contact details should they wish to be involved with any future research emanating from this line of enquiry).

For the study, any coach that actively coached sport activities were considered for the study. Because a substantial proportion of the coaching workforce does not possess a formal coaching qualification (Sport England, 2020), it was felt that this inclusion criteria was necessary to prevent preclusion of a large representative sample of coaches in the UK. The data collected from one participant (who indicated that they had never coached or guided sport or physical activity) was removed from the final analysis.

Design of the Data Gathering Procedure: The Survey

The main purpose of a descriptive survey is to understand current situations, such as views, opinions and perspectives of a sample at any given time or place (Tanner, 2018). Alternatively, a fitting term for the data collection procedure used in this study is a *status* survey, since the data collected was intended to represent a particular snapshot in time and place (i.e., post COVID-19 and in the midst's of sport coach training being reformed). As previously described, participants were invited to complete the survey online. Although response rates for online surveys are often low (Tanner, 2018), it offers participants the opportunity to be more candid in their answers, whilst also offering a more convenient and cost-effective method given the measures in place related to the management of the COVID-19 pandemic in the UK at the time.

The survey embedded participant information and informed consent, followed by six sections containing questions requiring a mixture of categorical, Likert-type scales, and multiple-choice answer responses, with a concluding section eliciting qualitative, free-text answers. The first two survey sections established demographic information pertaining to the participants. The *Background* section contained questions to determine gender, age and ethnicity, whilst the *Your coaching* section consisted of nine questions to determine details about each respondents coaching, including location and setting of coaching, participant details (such as age, gender, ethnicity and performance level), and employment status (e.g., paid, voluntary or a mixture of both). The questions in the first two sections were based on previous surveys examining the coaching workforce. For example, age and ethnicity categories were the same as those used by previous surveys (e.g., Thompson et al. 2020) and the Active Lives survey (Sport England, 2020).

The *More about your coaching* section contained eight further questions that elaborated on the participants background and expertise, including sport(s) coached, highest level of coaching qualification, time spent since achieving highest qualification, level of formal education, and membership of professional bodies. Classification of sports coached, and highest level of qualification were similarly based on coaching workforce surveys (Thompson et al., 2020), using the same categories of sports. However, the response options for these questions were modified to allow participants to identify more than one sport/qualification. The final question in this section asked about whether the coach was also a coach developer and the role they had in developing coaches.

The final two quantitative sections of the survey were specific to the aims of the research, in that they explored participants' opinions on topics and disciplines of sport science. Based on the disciplines and topics used in similar surveys by Williams (2005; Williams & Kendall, 2007b), Hedlund et al. (2018), and those outlined in Tables 1a and 1b (pgs. 41 and 42; ICCE, 2016), the *Sport science: knowledge and topics* section employed multiple-response style questions where participants rated the importance of each discipline (e.g., Physiology, Biomechanics etc.) and topic (e.g., Recovery Techniques, Mental Preparation etc.) against a question requiring a four-point Likert scale (Not Important, Important, Very Important, Essential) answer. In contrast to Williams (Williams, 2005; Williams and Kendall, 2007a), who used five-point Likert scales, these questions employed a four-point scale to neutralise the dangers of inadequate intermediate responses (e.g., Asún et al*.,* 2016). Similarly, a *Preferences for keeping up to date* section was based on a similar set of questions used by Williams (2005; Williams and Kendall, 2007b), updated to reflect contemporary methods of knowledge acquisition including online learning platforms and the internet.

The final qualitative section (titled *Your Views on Coach Development, Training and Education*) asked a question on barriers to development of sport science knowledge, as well as questions on the role and function of further and higher education, national governing bodies and continued professional development in the development of coaches' knowledge. Not only did these questions allow for comparison and substantiation of the findings from the first study, but they also enabled reliability

and validity to be enhanced and established credibility of the respondents (e.g., Fusch et al, 2018).

Methods of Analysis

Quantitative Survey Questions

Data generated from the quantitative online survey questions were downloaded from Google Forms into a Microsoft Excel spreadsheet for further exploration and description. For each question that required the selection of a single response (i.e., nominal data), frequency data were generated for each response in percentages. For questions that allowed multiple choice answers, frequency statistics were generated for percentage of cases (rather than responses) using cross-tabulation. Similarly, because the Likert-type responses were of an ordinal nature, frequency data were generated for each item on the scale in percentage of cases (Boone & Boone, 2012).

One of the proposals from the first study was that there were critical differences in sport science knowledge acquisition and translation between routine and adaptive experts. Owing to its ordinal and categorical nature, Chi-Square (X^2) analysis was conducted on Likert-type response data, comparing those coaches who were unqualified or possessed entry-level certification (routine experts) with those that possessed UKCC Level 3 or above (adaptive experts). SPSS for Windows v.26 (IBM, 2019) was used to conduct the analysis, with a statistical alpha level set at $p \leq 0.05$.

Qualitative Survey Questions: Thematic Analysis

Qualitative free-text responses were analysed thematically adopting the same approach as the first study presented in this thesis (pages 112-114; Braun & Clarke,

2006). Because the data was already in text format (rather than recorded), the first

stage of transcription was not necessary.

Results

Participants

Gender, Age and Ethnicity

Figures 5a and 5b show the proportion of participants, determined by gender and age. Of the forty-three participants that satisfied the study inclusion criteria, thirty-three identified as Male and ten identified as Female (77 and 23% respectively), whilst 20 (47%), 4 (9%), 8 (19%), 8 (19%) and 3 (7%) of the participants indicated their age as being 18-24, 25-34, 35-44, 45-54 and 55-64 years old respectively. In addition, 95% (40) of the participants identified as being White British, with the remaining coaches being either Mixed Race (n=1, 2%) or of Caribbean descent (n=1, 2%). Most respondents were situated in the North of England with 69% of participants in Yorkshire and Humber (n=19, 44%) and the Northwest (n=11, 26%) (see Figure 5c).
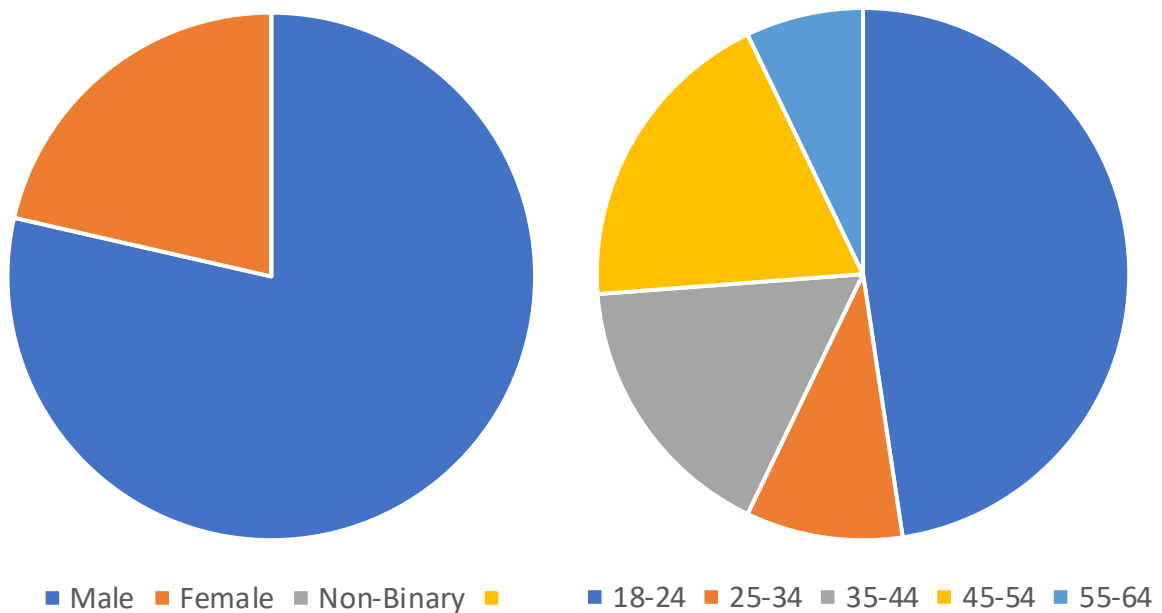
Figures 5a and 5b: Pie charts to show proportion of coaches by gender (Left) and age (Right)

Type of Coaching

Figures 5d-5f shows the employment status, gender and age of participants coached. 67% of coaches received some sort of remuneration for their coaching, either paid only (n=13, 30%) or a combination of paid and voluntary (n=16, 37%), with the remaining 33% undertaking voluntary coaching only (Figure 5d). 51% (n=22) of the participants described their coaching as Mixed Gender, with a further 33% (14) coaching Men or Boys Only and 14% (6) coaching Women or Girls Only (Figure 5e). The age range of participants were similar, though a higher number of coaches worked with Older Children (10-13 years) (n=12, 28%) and Young Children (5-9 years) category (n=11, 26%), than Young People (14-17 years) and Adult (18-50) (both n=10, 23%) participants (Figure 5f).
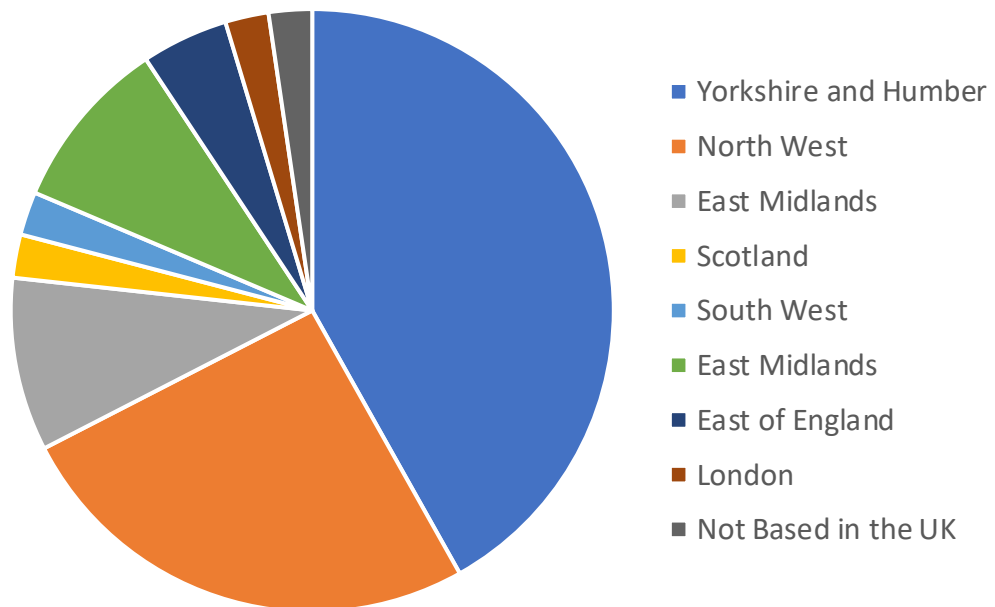

Figure 5c: Pie chart to show proportion of coaches by location
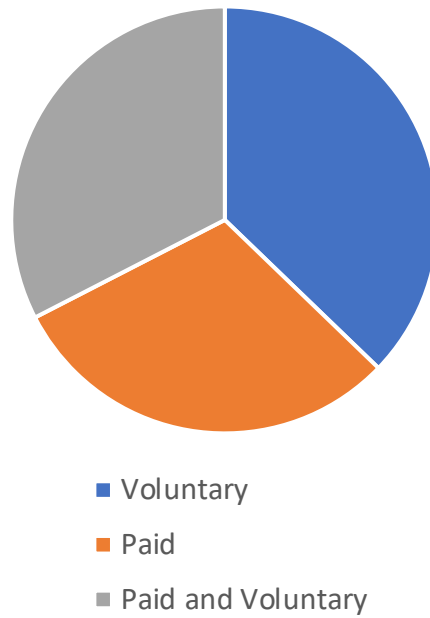
Figure 5d: Pie chart to show proportion of coaches by employment status
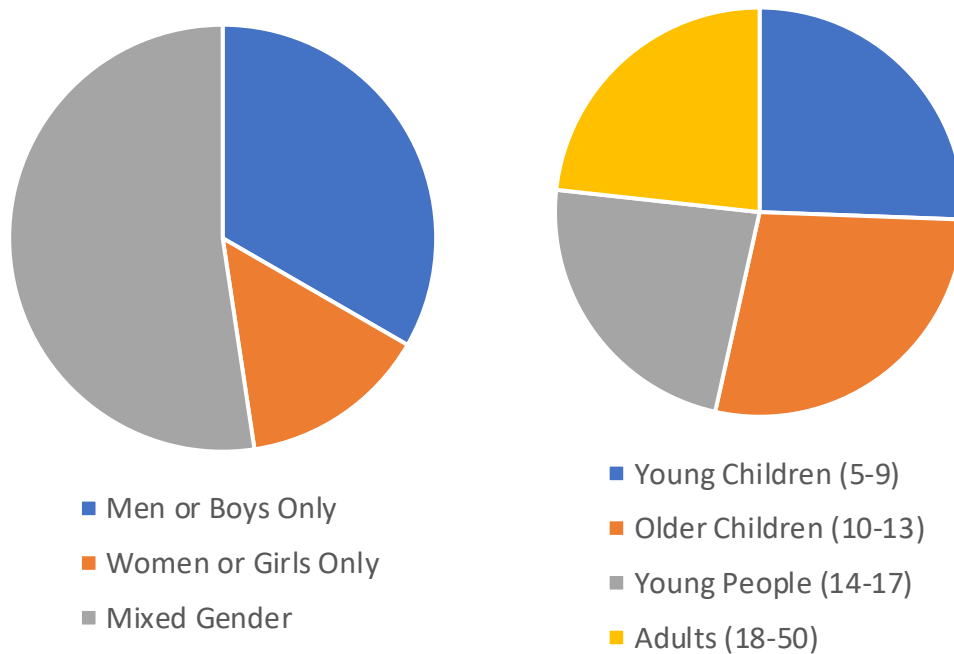
Figures 5e and 5f: Pie charts to show proportion of coaches by participants' gender (Left) and age (Right) characteristics

Figure 5g shows the level at which coaches were primarily delivering at, with New to the sport (n=7, 16%), Recreational Level (n=10, 23%), Club Level (n=12, 28%) and District, County or Regional Level (n=7, 16%) representing the majority of responses, with a further six participants delivering at Academy, National or International levels within the sample.
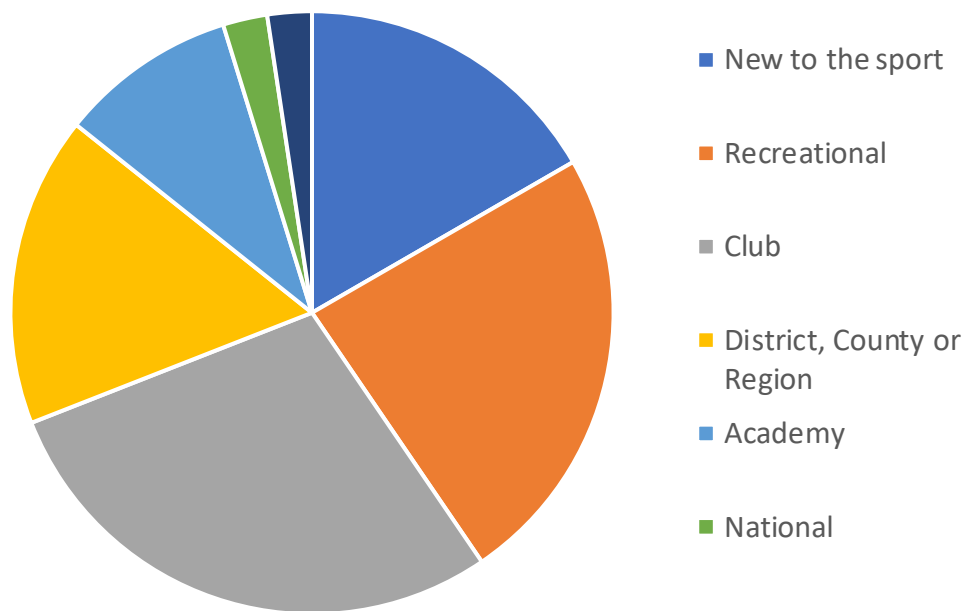
Figure 5g: Pie chart to show proportion of coaches by level

More about your coaching

Most participants coached Invasion Games (n=25, 58%), with Multi-Skills, Gymnastics and Trampolining, Net/Wall/Racquet Games, Outdoor/Adventure Sports, Combat Sports and Water Sports also represented within the sample. In terms of highest level of coaching qualification achieved, ten participants (23%) reported that they had no formal coaching qualification, a further 17 participants (40%) reported that they possessed either a UKCC Level 1 or 2 (or equivalent) and 16 participants (37%)

possessed UKCC Level 3 or above (Figure 5h). 84% (n=37) of participants revealed that they had coached within the past six months, whilst the remaining six participants had coached within the past two years. Regarding level of education, seven participants (16%) reported their highest level of qualification was below undergraduate degree, 49% (n=21) revealed undergraduate degree to be their highest qualification, whilst the remaining 35% (n=15) possessed either postgraduate taught or postgraduate research degrees (Figure 5i). Only one participant with an advanced (i.e., Level 3 or above) coaching qualification did not possess at least an undergraduate degree.
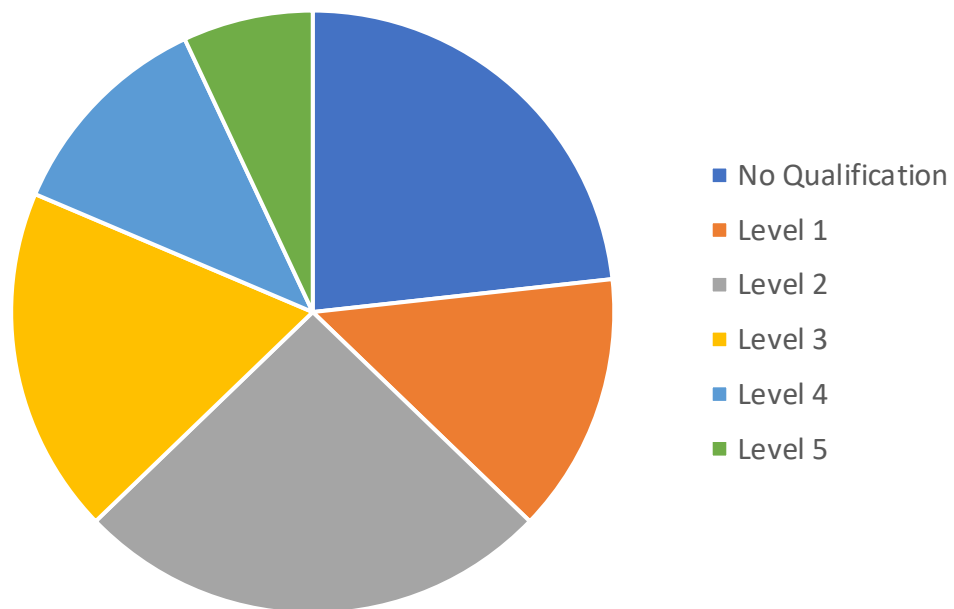
Figure 5h: Pie chart to show proportion of coaches by highest coaching qualification
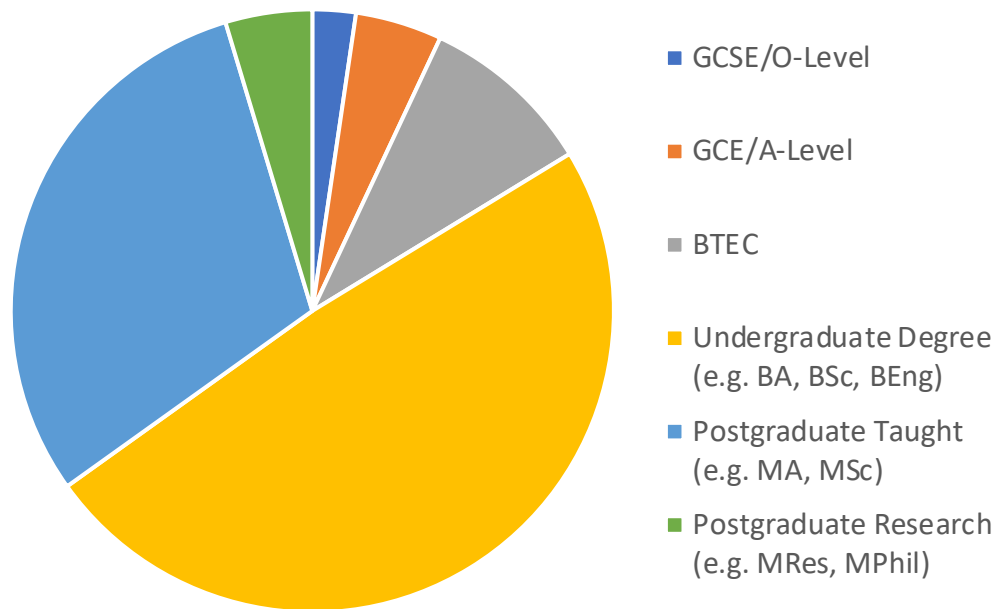
Figure 5i: Pie chart to show proportion of coaches by highest education achieved

55% (n=24) of participants revealed that they contributed to the development of coaches in some way, whether as a coach developer (n=6, 26%), coach educator (n = 7, 29%), or head coach (n = 2, 8%), whilst nine coaches (38%) reported that they did not have a title for their coach development role.

Actual and Preferred Methods to Keep Up to Date

Figures 6a and 6b show the actual and preferred methods of keeping up to date. Watching videos (n=37, 84.1%), the internet (n=33, 75%), attending workshops (n=27, 61%) and networking (n=26, 59%) were the most popular methods of currently keeping abreast of the latest knowledge and information, whilst a small number of coaches (n=3, 6.8%) revealed that they did not employ any methods to keep up to date (Figure 6a). Seventeen coaches (38%) also identified scientific journals as a source of current information. Peer discussion (n=31, 71%), interaction with other coaches (n=36, 82%) and face-to-face workshops (n=29, 66%) were the most selected

preferred methods for keeping up to date, though a large number of other options were also selected, including Applied Journals and Books (n=11, 25%), Conferences (n=14, 32%), Networking (n=16, 36%), Through a Mentor (n=11, 25%) and Online Workshops (n=16, 36%).
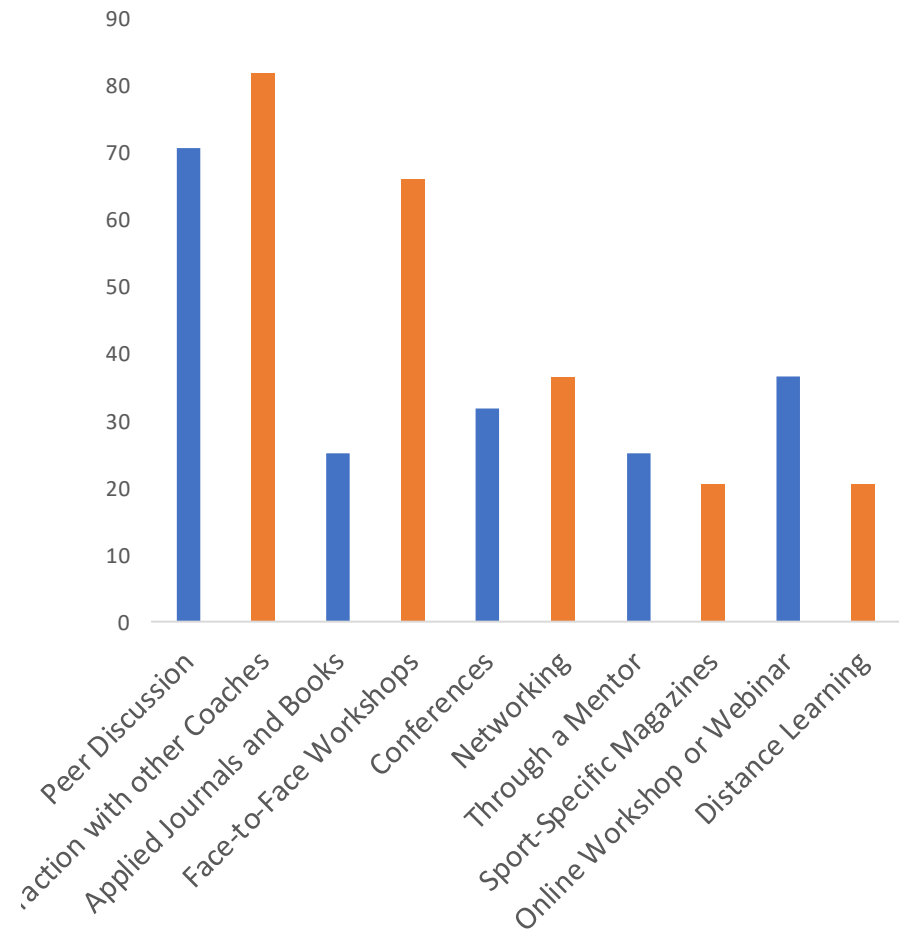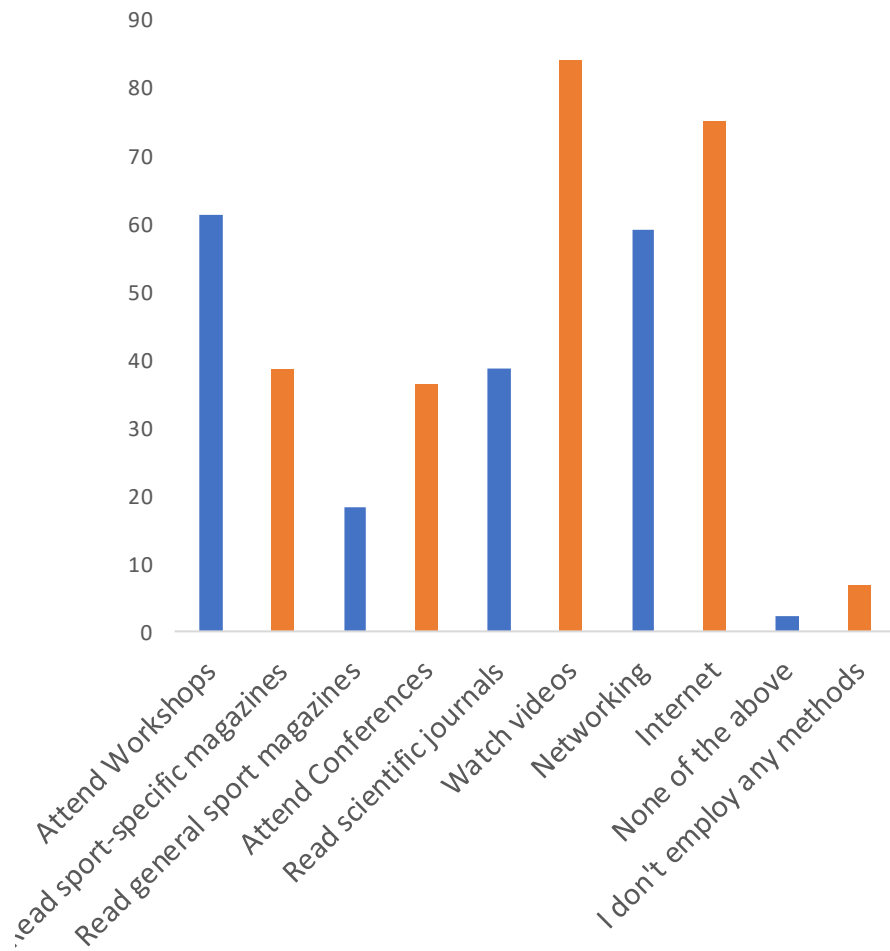
Figures 6a and 6b: Responses to the questions regarding actual (Left) and preferred (Right) methods to keep up to date as a sport coach (% of cases)

Figure 6c shows the results of the thematic analysis undertaken for the qualitative question asking about barriers to further developing sport science knowledge. The main barrier to further developing sport science knowledge was time, with fourteen participants referring to this as a primary source of discontent. Other barriers included cost, availability, location/access, and other conflicting demands (such as paid work and family). Notably, 'National Governing Body' was also identified as a barrier, with comments including '*NGB have little or no interest in developing these areas with coaches*' and '*NGB has a perception of "Jobs for the boys"*', and 'Motivation', where participants either expressed no interest or recognised there was no need once they achieved their coaching certificate.

Figure 6c: Thematic analysis of the free-text responses to the question 'What are the main barriers to further developing your coaching knowledge in the sport sciences?' (Number of times referenced in subscript text)

Sport Science: Topics and Importance

Figure 7a shows the perceived importance of each sport science and medicine discipline as they relate to the role of the coach, with only two disciplines (those of

'Skill Acquisition' and 'Psychology') being rated as 'Important' or greater by all participants. Two areas of sports medicine ('Therapeutic Modalities' and 'Medicine') were viewed as being least important with a high proportion of participants viewing theses as being 'Not Important'.

Figure 7a: Responses to the question 'For each of the topics presented, rate their importance to your role as a coach' (R: Routine Experts; A: Adaptive Experts)

Chi-square analysis revealed statistical differences between routine and adaptive experts for Psychology (X^2 (3, N = 43) = 11.24, p = .004) and Performance Analysis (X^2 (3, N = 43) = 9.38, p = .025), whilst Skill Acquisition (X^2 (3, N = 43) = 5.91, p = .052) displayed a trend toward significance at p<0.06 (see Table 5). Closer inspection of the data revealed that more adaptive experts rated Psychology as Important, whilst more routine and adaptive experts rated Performance Analysis as 'Essential' and 'Not Important' respectively (see Figure 7a).

Table 5a: Chi Square Values for Sport Science Discipline by Expertise (* denotes statistical significance at p ≤ 0.05; ** denotes trend towards significance)

Sport Science Discipline	Pearson Chi-Square (X^2) Value	Statistical Significance
Biomechanics	2.672	.445
Physiology	3.174	.366
Psychology	11.244	.004*
Nutrition	5.352	.148
Strength and Conditioning	4.092	.252
Performance Analysis	9.375	.025*
Skill Acquisition	5.906	.052**
Therapeutic Modalities	2.531	.282
Medicine	4.193	.241

Figure 7b shows the perceived importance of popular sport science topics as they relate to the role of the coach. Topics typically associated with the broader subject of skill acquisition ('Improving Technique/Efficiency') and sport psychology ('Coping with Adversity', 'Goal and Target Setting', and 'Mental Preparation') were rated most favourably by participants, as measured by the number of coaches that rated these

topics as 'Important' or greater. The topics of 'Nutritional Supplementation', 'Weight Management/Control', and 'Reducing Illness' had the highest number of coaches' stating that these were 'Not Important'.

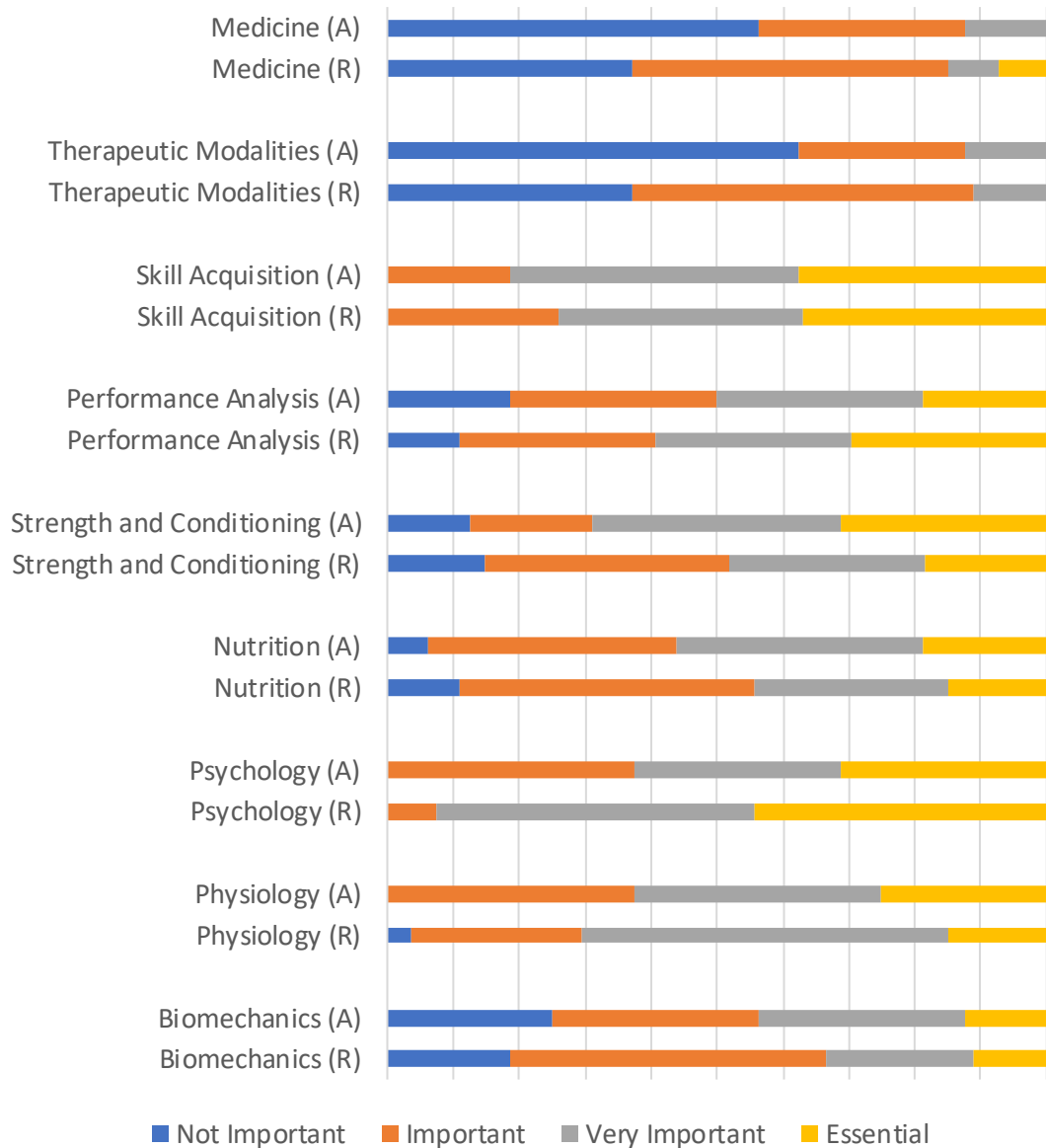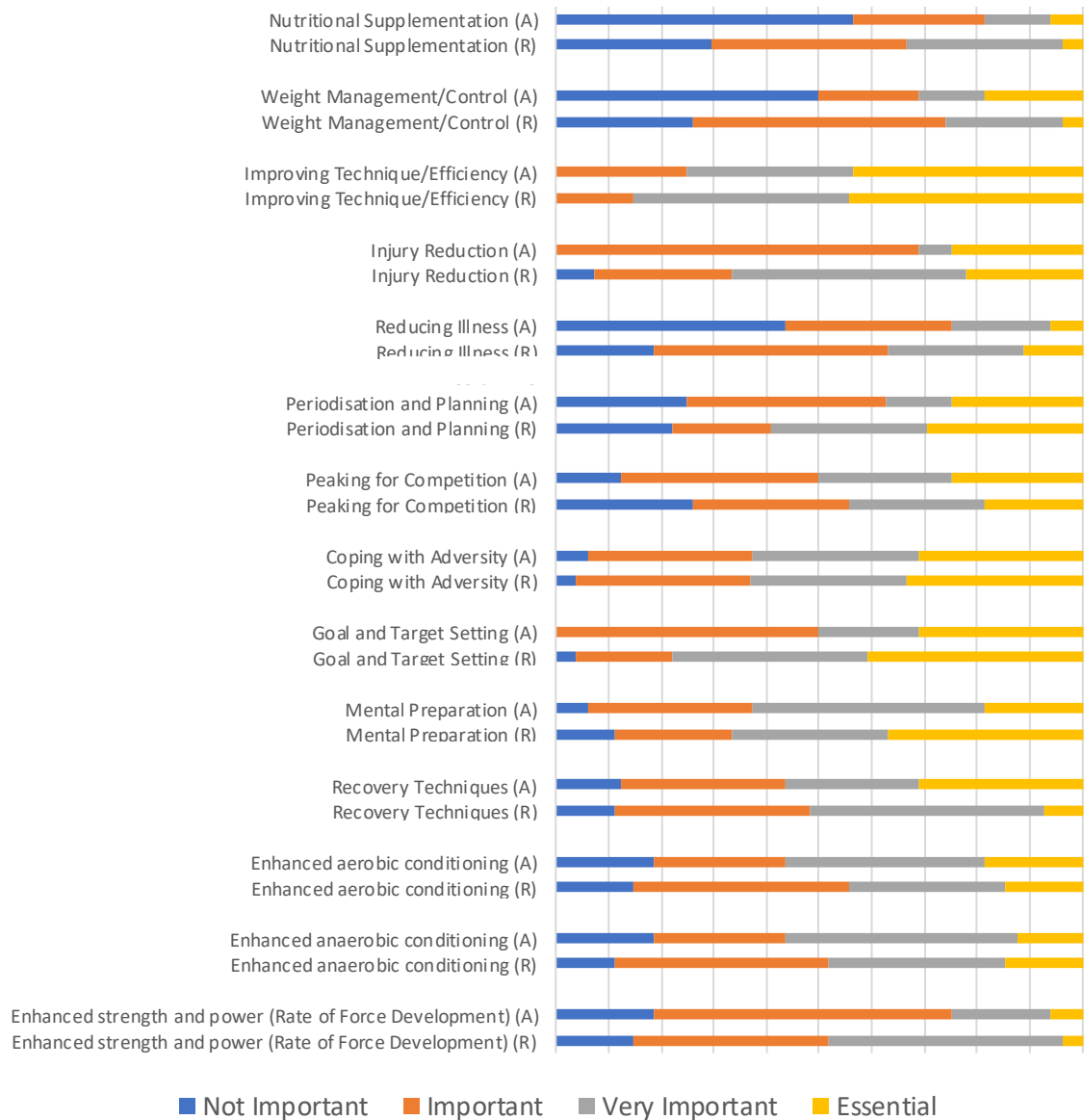**Figure 7b:** Responses to the question 'For each of the topics presented, rate their importance to your role as a coach' (R: Routine Experts; A: Adaptive Experts)

Chi square analysis revealed several statistically significant differences between routine and adaptive experts in the topics of 'Enhanced Anaerobic Conditioning', 'Enhanced Aerobic Conditioning', 'Mental Preparation', 'Goal and Target Setting',

'Coping with Adversity', 'Peaking for Competition', 'Periodisation and Planning' and 'Improving Technique/Efficiency' (see Table 5b), though these were primarily seen in differences between how participants rated topics important or very important (see Figure 7b).

Table 5b: Chi Square Values for Sport Science Topics by Expertise (* denotes statistical significance at p ≤ 0.05)

Sport Science Topic	Pearson Chi-Square (X^2) Value	Statistical Significance
Enhanced Strength and Rate of Force Development	3.751	.290
Enhanced Anaerobic Conditioning	9.378	.025*
Enhanced Aerobic Conditioning	8.335	.040*
Recovery Techniques	5.740	.125
Mental Preparation	15.681	.001*
Goal and Target Setting	12.664	.005*
Coping with Adversity	15.090	.002*
Peaking for Competition	11.012	.012*
Periodisation and Planning	14.269	.003*
Reducing Illness	5.761	.124
Injury Reduction	2.400	.494
Improving Technique/Efficiency	7.243	.027*
Weight Management/Control	4.927	.177
Nutritional supplementation	4.803	.187

Figure 7c shows participants' responses to questions related to when the same sport science topics should be introduced to the coach, with a balance of participants locating the topics across the coaching curriculum from 'Not Necessary' to 'Level 5'.

No statistical differences were observed between routine and adaptive experts for this question (see Table 5c).
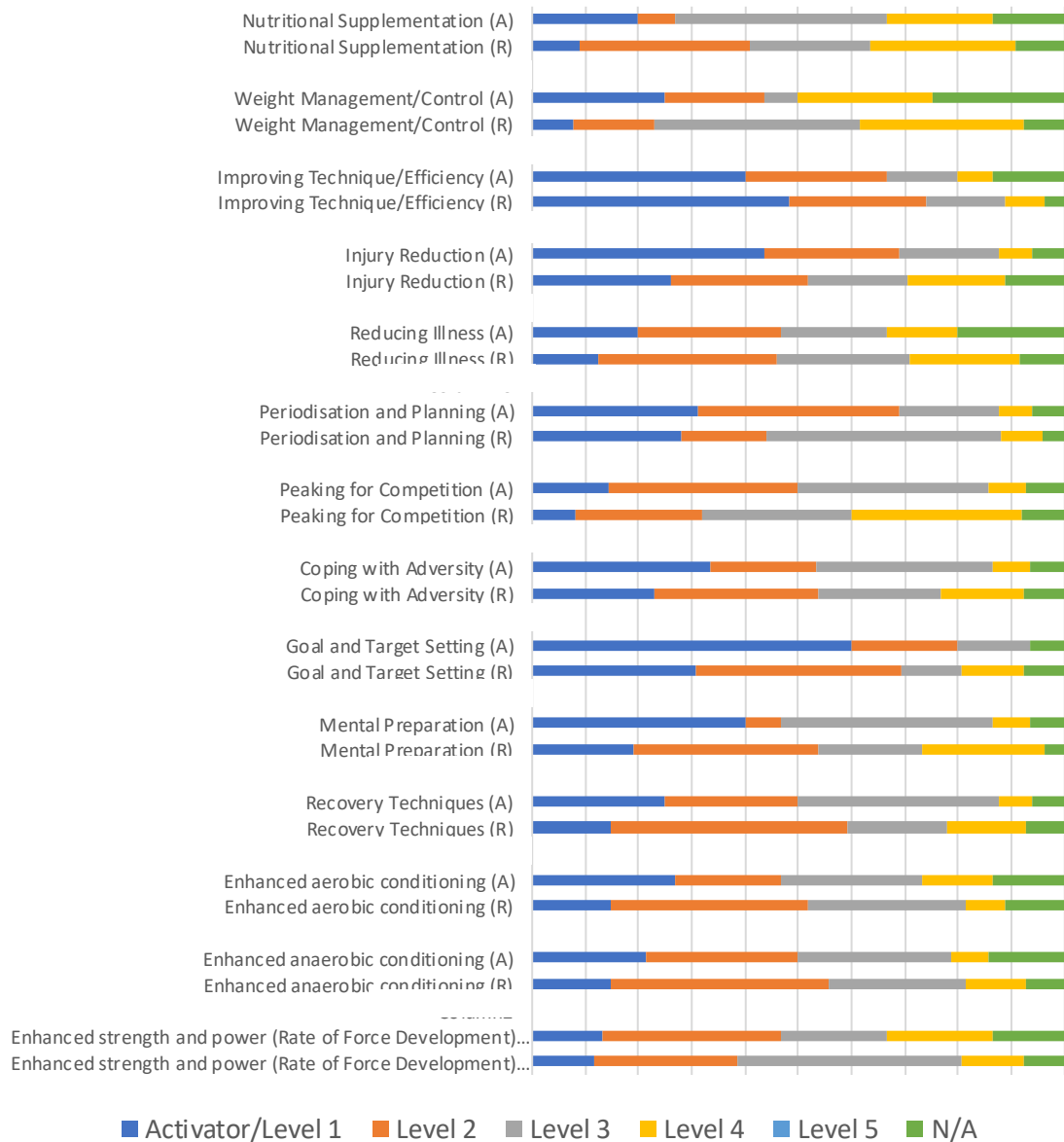
Figure 7c: Responses to the question 'At what level of coaching do you feel that the following topics should be introduced?' (R: Routine Experts; A: Adaptive Experts)

Table 5c: Chi Square Values for Sport Science Topics by Location in Curriculum

Sport Science Topic	Pearson Chi-Square (X^2) Value	Statistical Significance
Enhanced Strength and Rate of Force Development	3.306	.653
Enhanced Anaerobic Conditioning	5.726	.334
Enhanced Aerobic Conditioning	4.325	.504
Recovery Techniques	4.908	.297
Mental Preparation	5.237	.388
Goal and Target Setting	6.915	.227
Coping with Adversity	5.386	.371
Peaking for Competition	10.385	.065
Periodisation and Planning	6.012	.305
Reducing Illness	5.781	.328
Injury Reduction	4.841	.304
Improving Technique/Efficiency	7.832	.098
Weight Management/Control	2.752	.766
Nutritional supplementation	1.282	.937

The Role of NGBs, Further and Higher Education and CPD

Figures 8a, 8b and 8c show the results of the thematic analysis undertaken for the qualitative survey questions enquiring about the role of National Governing Bodies, further and higher education and CPD in coach training and education. Of the twenty-six participants that responded to the question related to NGBs, the most popular answers were related to Education, Coach development and maintenance of professional Standards (Figure 8a).

Figure 8a: Thematic analysis of the free-text responses to the question 'In your opinion, what should the role of a National Governing Body (NGB) be in developing coaches?' (Number of times referenced in subscript text)

The question related to further and higher education garnered thirty-five responses, with Knowledge being the most popular response. In addition, Education, Professionalisation, and Research were all frequently provided as answers. A small number of participants identified partnerships between NGBs and further/higher education as a feature of the roles of both NGBs and further and higher education

(Figures 7a and 7b). Of the 32 responses received to the question surrounding CPD, the most popular theme was related to the introduction of New ideas and Knowledge (Figure 7c).

Development$_4$ Education$_6$ Experience$_4$

Professionalisation$_5$

Applied
Practice$_3$ CPD$_2$

Knowledge$_{15}$

Partnerships
with NGB$_4$ Research$_5$ Resources$_2$

Figure 8b: Thematic analysis of the free-text responses to the question 'In your opinion, what should the role of Further and Higher Education be in developing coaches?' (Number of times referenced in subscript text)

Development$_5$ Knowledge$_6$ Networking$_3$

Applied   New Ideas$_7$
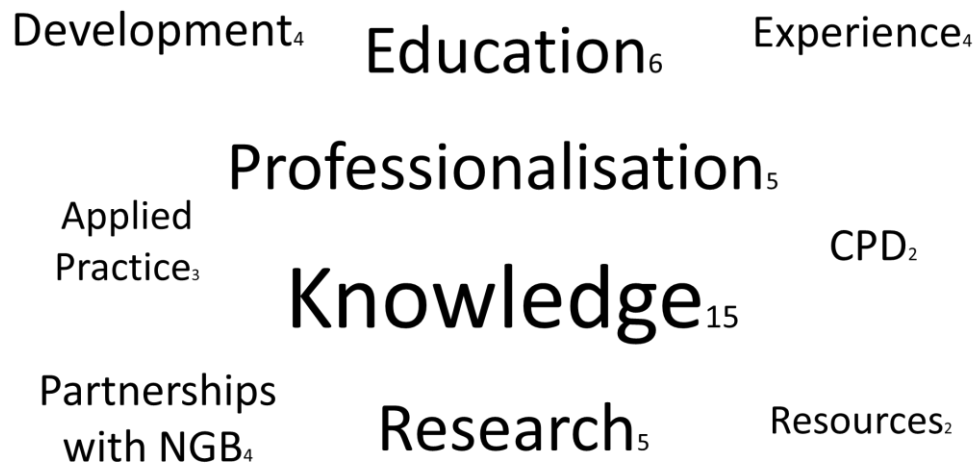Practice$_4$ Resources$_2$
                    Mentoring$_2$

Figure 8c: Thematic analysis of the free-text responses to the question 'In your opinion, what should the role of CPD be in developing coaches?' (Number of times referenced in subscript text)

Discussion

The aims of the second study were to better understand what value sport coaches placed on sport science topics and knowledge, to determine the preferred location of this knowledge in the coach training and education curriculum, and to establish the role and function of further and higher education (FHE), National Governing Bodies of sport (NGBs) and continued professional development (CPD) in the knowledge acquisition and translation process. An online survey was used to collect both quantitative (in the form of Likert-type and multiple-choice responses) and qualitative (in the form of free-text answers) data.

Actual and Preferred Sources of Knowledge

Consistent with previous literature examining *actual* sources of coaching knowledge (e.g., Williams & Kendall, 2007b; Reade et al., 2008a; Kilic & Ince, 2015; Stoszkowski and Collins, 2016; Nkala, 2019), coaches in this study reported accessing a variety of sources for their sport science knowledge needs. Understandably, given that the survey was conducted online during an extended period of social distancing measures associated with the COVID-19 pandemic, digital sources of knowledge proved most popular in this study with Watching Videos (84%) and the Internet (75%) being the highest regarded amongst the participants, though many participants also identified other formal and non-formal learning opportunities, such as Workshops (61%) and Conferences (36%), and informal learning opportunities, such as Networking (59%), amongst their options (Figure 6a). Reassuringly, regardless of level of coach and/or educational background, only a minority of participants (n=3) did not engage in any methods to keep up to date. Findings were also consistent with the

first study presented in this thesis, where expert coaches identified a mixture of formal, non-formal and informal learning opportunities as important and valuable sources of sport science knowledge.

The number of cases reported for *actual* sources of sport science knowledge, specifically increased use of digital/online resources and less use of informal sources involving interaction with other coaches/peers, were observed when comparing to previous research on the subject. This could be accounted for by the COVID-19 pivot and the chronological age of previous studies. For example, Reade et al. (2008a) reported only 1% of coaches using online methods as a source of knowledge and less than 10% of the coaches surveyed by William & Kendall (2007b) reported using the internet for this purpose. In contrast, this figure increased to 17% and 41% in the studies by Stoszkowski and Collins (2016) and Kilic and Ince (2015) respectively and was cited by over half of the coaches surveyed by Nkala (2019). As such, a trend through time in similar studies suggests greater use of the internet and online sources of knowledge by sport coaches c.2022. Likewise, when compared to this study, greater numbers of participants identified informal sources of knowledge in these previous studies, all of which took place before the pandemic and when formal and non-formal coach training and education took place face-to-face. No formal NGB coach certification was delivered during the pandemic, with measures put in place by many NGBs to allow unqualified coaches to deliver supervised sessions as part of their returning to train and play protocols (e.g., RFL, 2021), so it is no surprise that coaches that participated in this study identified online sources more frequently than in previous studies.

What was a particularly interesting finding from the survey was the number of participants that identified 'Reading scientific journals' as a current source of sport science knowledge, with 39% revealing academic research as a method to keep updated. Despite conducting their research with mostly university sport coaches, both Reade et al. (2008a) and Stoszkowski and Collins (2016) found only small numbers (<4%) of their participants were engaging with peer-reviewed academic literature as a source of sport science knowledge, further supported by comments made by participants of the first study in this thesis alluding to a culture of coaches not reading research. This was despite the level of educational background and coaching certification in these studies being of similar levels to the coaches surveyed for this study. It could be speculated that these differences may have been reflective of the need for participants to seek out alternatives to informal learning opportunities as a result of the COVID-19 pandemic, or that a lack of active coaching during the pandemic offered participants the opportunity to devote more time to learning.

The findings may also be indicative of the ongoing reform of coach development in the UK impacting on the appetite of sport coaches to access sport science knowledge. Equally, it may be due to the greater number of academic publications available to the public as a result of an increase in open-access journal availability or the increased popularity of research websites such as ResearchGate, where researchers will often provide free copies of their research. The findings also substantiate an observation made in the first study of this thesis, which suggests that limited sport science

knowledge is available in NGB coach training and, as such, participants must use alternative methods to acquire this knowledge when they are motivated to do so.

It is not possible to compare any differences in preference to knowledge sources between those with and without graduate characteristics, owing to most coaches in this study being educated at undergraduate degree level or above. However, it could be surmised that participants identified academic literature as a source of sport science knowledge because of their educational backgrounds in further and higher education. This is consistent with Mesquita et al. (2010), who observed statistically significant differences in use of knowledge sources between Portuguese coaches with and without a higher education background in Physical Education. It could also be inferred that the findings of this study reinforce the position of Williams and Kendall (2007b), who reported that the coaches in their study agreed that the ability to read, understand and interpret the findings of academic research in the sport sciences was an important feature of superior quality sport coaching.

Though 'Face-to-Face Workshops' (66%), 'Conferences' (32%) and 'Online Workshops or Webinars' (36%) were still chosen, participants highlighted 'Interaction with other coaches' (82%) and 'Peer Discussion' (71%) as *preferred* sources of sport science knowledge (Figure 6b), consistent with the findings of Stoszkowski and Collins (2016) and Kilic and Ince (2015) who both report interaction/communication with other coaches as a preferred knowledge source. Notwithstanding the observations made above, regarding the COVID pandemic and possible explanations for increased use of online learning sources, it is clear from these findings that coaches place great

significance on the ability to engage with others in informal settings when safe to do so.

Despite reservations about the uncritical nature of informal learning (e.g., Cushion et al., 2010; Piggott, 2012; Stoszkowski & Collins, 2016) and the prevailing belief that many coaches do not possess suitable levels of declarative knowledge to compare and contrast new knowledge in these settings (Abraham & Collins, 2006), it is evident that more needs to be done to establish methods to recognise and accredit informal learning within the UK Coaching Framework (Dray et al., 2016), possibly adopting methods similar to those employed by other administrators of professional standards such as the HCPC (HCPC, 2022) where candidates in professions such as physiotherapy are able to log relevant formal, informal and non-formal learning as part of the accumulated CPD required to maintain chartered status. Equally, given that coaches also identified formal and non-formal sources of knowledge (such as face-to-face workshops, conferences, and mentoring), more needs to be done to foster learning environments where the coach candidate is at the centre of their learning, as recommended by Nash and Collins (2006), Twitchen and Oakley (2019), and Cushion et al. (2021) amongst others. This reflects observations made by Ciampolini et al. (2014) and Paquette and Trudel (2018b) regarding the use of more constructivist instructional strategies by Coach Developers. Again, findings in this study may reflect that these changes are already evident in some forms of coach training and education in the UK or might reflect the educational background (and subsequent preferences) of the participants that took part in the study.

Thematic analysis of the responses to the qualitative question about barriers to further knowledge development in the sport sciences revealed the often-cited challenges associated with the coaching workforce in the UK, namely time, cost, availability, and conflicting demands (Figure 6c). Given that time and cost are regularly put forward as barriers to continued coach education in the UK coaching workforce survey (Thompson et al., 2020) and Active Lives Adult Survey (Sport England, 2020), it comes as no surprise that participants suggested these barriers. Of interest in the context of this thesis was that 'National Governing Bodies' and 'Motivation' were also deemed to be barriers, with free-text comments from participants reflecting that NGBs have little interest in the promotion of sport science topics within their coach training and that participants were not motivated to seek out new learning when there was no requirement to do so, providing further support to the suggestion that NGBs could be considered closed circles (Piggott, 2012) and that there remains power imbalance between coaches and those responsible for their training and education in NGBs (Cassidy et al., 2009). Though only put forward by a small number of participants, this does promote the need for continued discussion around licensing and the professionalisation of the coaching workforce, as well as the need to initiate further discussion with NGBs about the value and benefit of sport science knowledge being embedded in various levels and types of coach training and education.

The survey used in this study did not explore coaches' *use* of sport science knowledge, rather the emphasis was on gaining further insight into the location of sport science knowledge and topics in coaching curriculum and how these could best be delivered

to coaches. However, given the level of uncritical application reported by Stoszkowski and Collins (2016) and the prevalence of pseudoscientific ideas among sport coaches (e.g., Bailey et al., 2018; Stoszkowski et al., in press), future research may want to specifically investigate levels of understanding and subsequent use of sport science knowledge gleaned from the different knowledge sources available to coaches.

Sport Science: Topics and Importance

Consistent with other studies investigating how coaches' perceived sport science topics and disciplines (e.g., Williams & Kendall, 2007b; Reade et al., 2008a; Kilic & Ince, 2015; Stoszkowski & Collins, 2016), topics related to 'Sport Psychology' and 'Skill Acquisition' were unanimously rated as being important by the participants in this study (Figure 7a). Interestingly, the disciplines of skill acquisition and sport psychology are both highlighted within UK Coaching's new Coach Learning Framework (UK Coaching, 2022) as areas for professional development so these findings are consistent with that new venture. Although statistical analysis revealed differences between routine (UKCC Levels 1 and 2) and adaptive experts (UKCC Level 3 and above), this was reflected in the level of importance placed on these disciplines with adaptive experts rating these areas as 'Essential' rather than 'Very Important' or 'Important' on the survey. A higher proportion of routine experts also rated 'Performance Analysis' as being unimportant, compared to their adaptive expert counterparts. In terms of average importance rating, the areas least popular amongst participants were those associated with 'Medicine' and 'Therapeutic Modalities'. Given that sport coaches are less likely to use any of the knowledge and skills from these areas in their day-to-day practice, this was not surprising and is common with

similar research identifying such areas being perceived as unimportant within similar samples of coaches (Williams & Kendall, 2007b; Reade et al., 2008a).

When exploring more specific topic areas, Chi Square analysis revealed eight (of 14) topics being rated differently between routine and adaptive experts (see Figure 7b and Table 5a). As with previous analyses, the differences were found in the degree of importance placed on the topic areas, with adaptive experts rating more topics areas as being 'Essential' with only one topic (Enhanced Anaerobic Conditioning) being rated as 'Not Important' by routine experts. Considering previous literature describing how adaptive experts assimilate and understand various sources of domain specific knowledge in the pursuit of solving context-specific problems (e.g., Berry, 2020; Mees et al., 2020), these differences could be attributed to advanced coaches being more aware of their knowledge needs to support the development of their athletes. Alternatively, as previously discussed elsewhere in this thesis, it may simply be because coaches in possession of a UKCC Level 1 or 2 qualification have not yet been exposed to these sport science topics as part of their NGB coach training and therefore do not possess the prerequisite declarative knowledge base to make informed decisions on their importance (Abraham et al., 2006).

When examining participants' views on the location of sport science topics in the coach curriculum, specifically in their responses to the question 'At what level of coaching do you feel that the following topics should be introduced?', some interesting observations can be made. Firstly, many participants suggested that topics should be introduced to Level 1 coaches (See Figure 7c and Table 5b). Indeed, Level 1 was the predominant response for the topics rated as the highest importance

on previous questions ('Improving Technique/Efficiency' and 'Goal and Target Setting'). Furthermore, apart from the topics on 'Nutritional Supplementation', 'Weight Management/Control', and 'Peaking for Competition' (where approximately 10% or more of participants suggested Level 4 as the right location), an equal split of participants suggested locating other topics of sport science at either Level 2 or Level 3. This was despite there being no statistical differences between routine and adaptive experts for the responses to these questions and therefore was not dependent on experience or level of coach.

Though sample size prevented any statistical analysis being undertaken, visual analysis of the raw data did not suggest any differences in suggested location of sport science topics between coaches when considering age of participants or level of ability coached. Equally, no differences were identified by sport coached or education level, though the considerable number of invasion game coaches and those with undergraduate degree level education or above in the sample would have skewed this data. As such, whilst factors such as education level, level of participant ability or sport coached *could* mediate coaches' preferences for the delivery of certain sport science topics (e.g., Turner & Nelson, 2009), data generated from this study indicates that no such patterns or trends exist in this population of coaches.

It could be surmised on the basis of these findings that the introduction of sport science knowledge, like other aspects of sport coaching knowledge, are of an individualised nature and that decisions surrounding level of importance and location are mediated by an individuals' biography and other moderating factors personalised to each coach (Stodter & Cushion, 2017). Another assumption, based on the small

number of coaches responding with 'Not Necessary/Important' to the questions on location of topic knowledge, supports Stodter's (2014; Stodter & Cushion, 2017) view that openness to innovative ideas is a key moderating factor that was largely prevalent amongst the well-educated and willing coaching workforce represented by this study.

It is debatable how much could be gained from inferring too much about the location of sport science topics in the coaching curriculum beyond the individualised level. However, the findings do support the notion that entry-level coach training should contain more sport science knowledge, particularly surrounding the areas of sport psychology and skill acquisition. Equally, the fact that many participants felt other topics should be introduced at Level 2 supports a proposal made earlier in this thesis surrounding the introduction of sport science knowledge to lower levels of coach training. Whether that is through NGB coach certification programmes or through mandatory CPD, as is the case for a large number of other professions including accountancy (e.g., West, 2016) and the fitness industry (e.g., CIMSPA, 2022) that require engagement with CPD to satisfy professional standards and membership, remains to be seen. What is clear from the results of this survey is that sport science knowledge has a place in coaching curriculum, substantiating findings of the first study in this thesis and further supporting the findings of previous research (e.g., Williams & Kendall, 2007b; Reade et al., 2008a; Kilic & Ince, 2015; Stoszkowski & Collins, 2016).

As previously mentioned, a possible explanation for why there were no observed differences between levels of expertise for these questions may lie in the educational

background of the participants, considering that only a small number were not in possession of at least an undergraduate degree. Though the survey did not ascertain the subject of participants' highest level of educational qualification, it could be inferred that all participants (regardless of their level of coaching qualification) were accustomed to approaches to education that were more learner-centred in their delivery and application as a result of this education (e.g., Ciampolini et al., 2014) and therefore accustomed to learning as an adult (Knowles et al., 2005). As such, participants were able to suggest the location of the sport science topics regardless of level of expertise based on their previous life and work experiences as an athlete, coach or student (Taylor & Kroth, 2009).

Since the survey was designed to elicit views and opinions on sport science topics alone, rather than on a broader range of topics that could form part of coach training and education, other popular topics cited in previous research, such as 'How to Coach' and 'Communication' (Stoszkowski & Collins, 2016) and 'Tactical/Strategy' (Reade et al., 2008a; Kilic and Ince, 2015), were not available responses to the participants of this study. Though the focus of this thesis has been on sport science knowledge, further research may want to explore the location of other types of coaching knowledge employing the same approach as this study. That is, rather than ranking topics (Williams & Kendall, 2007b) or questioning coaches on what they need to know (Stoszkowski & Collins, 2016), a larger-scale piece of research exploring when and how topics of interest are introduced to sport coaches is warranted. This may take the form of sport-specific enquiry, similar to how the Football Association partnered with Loughborough University to part-sponsor the PhD of Anna Stodter

(Stodter, 2014), or consider target population/domains as defined by the International and European Sport Coaching Frameworks (ICCE et al., 2013; Lara-Bercial et al., 2017) and proposed by Hedlund et al. (2018) in their proposed educational framework distinguishing between participant- and performance-level coaches and professional, intrapersonal and interpersonal knowledge domains.

The Role of NGBs, Further and Higher Education and CPD

Thematic analysis of the free-text responses to questions surrounding the role and function of NGBs, further and higher education (FHE), and CPD in coach development provided some useful insight into current thinking within the sample of coaches surveyed for the second study. The theme of 'Development' occurred in all three analyses, whilst other crossover themes were observed between NGB/FHE in the themes of 'Partnerships (with each other)', 'Education' and 'CPD', the themes of 'Applied Practice' and 'Resources' between FHE/CPD and the theme of 'Mentoring' between NGB/CPD.

The analysis of responses associated with NGBs highlighted 'Standards' and 'Qualifications' as being unique themes (Figure 8a), suggesting that coaches surveyed were confident NGBs were the right 'home' for the establishment and maintenance of sport-specific coaching certification and training, as well as being jointly responsible for coach development in collaboration with FHE providers. Despite previously published reservations about the role NGBs have in coach training, including the danger of indoctrination and conforming (e.g., Piggott, 2012; Leeder & Cushion, 2021) and reluctance to relinquish control (e.g., Twitchen & Oakley, 2019), the broad range of participants completing the survey still recognised the value of

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NGBs in coach development, though this was not specific to sport science. Recent developments, including the introduction of UK Coaching's 'Coach Learning Framework' (UK Coaching, 2022) and CIMSPAs professional standards for coaching, may be the catalyst for discussion surrounding the future role and function of NGBs in coach development.

The 'direction of travel' of sport and physical activity coaching in the UK appears to sit within a complex political landscape that involves individual sports (i.e., NGBs), agencies of change (e.g., Sport England, UK Coaching, CIMSPA) and those responsible for and the promotion of professional regulation (i.e., ICCE). Notwithstanding this, it is not clear at time of writing how the relationship between these bodies, particularly between CIMSPA and NGBs, will develop. It could be that the current consultation by Sporting People (2022a) on Sport England's Coaching Plan 2.0, which includes representation from a number of NGBs (including the Football Association and Rugby Football Union), CIMSPA, Sport England and the ICCE, will provide further insight into the role of NGBs in coach training and education, though the mid-term update on this consultation suggests otherwise with confusion reported about a 'perceived lack of clarity with regards who is doing what within the coaching ecosystem' (Sporting People, 2022b, pg. 6).

The distinct themes of 'Knowledge', 'Research' and 'Professionalisation' identified in the FHE analysis (Figure 8b) suggest that coaches perceived a vital role for further and higher education in elevating levels of coach training and education, building on previous work calling for increased involvement of FHE to raise standards of sport coaching (e.g., Turner & Nelson, 2009; Stonebridge & Cushion, 2018). It is suggested

that findings from this study, coupled with the recommendations of the International and European Sport Coaching Frameworks (ICCE et al., 2013; Lara-Bercial et al., 2017) that knowledge and skills of Level 3 sport coaches should be aligned to undergraduate degree level, support the belief that such partnerships should be in place for a lower level of coach training and education than Level 4 (where partnership between NGBs and FHE are a mandatory component). Though reforms in higher education that have encouraged vocationally oriented undergraduate degrees are not without their critics, and certainly the role of CIMSPA in facilitating workforce development through partnership with universities has been questioned (e.g., Aldous & Brown, 2021), it would seem prudent for those responsible for developing sport coach training and education in the UK to take into consideration the role that FHE has to play in a wider context than at the highest levels of coaching alone.

One of the observations made in the first study in this thesis was the notion of key differences between the expert coaches being interviewed and other, less advanced coaches within their sports, supporting the explanation by Kuhlmann and Ardichvili (2015) that routine experts (those defined as competent using the expertise vernacular of Dreyfus & Dreyfus, 2014) will not reach proficient/expert levels as a result of over-reliance on coherent and well-developed routines employed during daily practice, possibly as a result of previously-discussed doctrines and approaches by NGBs of sport or related to the types of problems that entry-level coaches encounter in daily practice. Given that Dreyfus and Dreyfus (2004) suggest that level of education is a moderating factor in professional development, it could be

concluded that FHE should play a more significant role in the education of coaches beyond UKCC Level 2. It is therefore proposed that a key feature of Level 3 coaching should be the integration of sport science knowledge at the equivalent of undergraduate degree level, in the same way that postgraduate level knowledge forms an important part of Level 4 (see pages 32-33 for further explanation).

Other important themes identified in the FHE analysis were those of 'Applied Practice' and 'Experience', supporting the view that certain approaches to learning fostered by FHE (such as experiential learning and more constructivist approaches such as a flipped classroom; Cronin & Lowes, 2016) are favoured by sport coaches in developing their knowledge, understanding and application of concepts. It could be argued that this observation speaks more for participants' experiences of traditional NGB-led coach training, rather than necessarily viewing FHE as the panacea that will fix the 'errors' in sport coach training and education in the UK, but it does reinforce the importance of adopting more learner-centred approaches to coach development (e.g., Cushion et al., 2010; Stoszkowski & Collins, 2016; Twitchen & Oakley, 2019) as recommended in current policy (e.g., Sport England, 2016, 2021).

Thematic analysis of the question surrounding the role of Continued Professional Development (CPD) identified 'New Ideas' as a novel theme not provided as part of the responses to the questions on NGBs and FHE (Figure 8c). Though it might be argued that the purpose of CPD is to introduce innovative ideas to the audience, and is therefore not a revelation in itself, this finding does suggest movement in a positive direction regarding how CPD is perceived by sport coaches in the UK (at least by the participants that took part in this study). As recently as 2017, Nash et al. reported

mixed views and opinions on CPD from the coaches in their sample, noting the demands on the voluntary workforce and a lack of conceptual understanding of the role and benefits of CPD as being two of the limitations. The change in perspective may be as a result of greater acceptance and availability of digital information, the impact of the COVID-19 pandemic, education background of participants (though Nash et al., 2017, do not report the educational qualifications of their participants), or recognition of the changes in coach training and education observed in some sports already.

The response from participants may also simply be indicative of their interpretation of the question ('In your opinion, what *should*…') since no measurement of take-up in CPD opportunities was recorded as part of the survey data collection and a small number of participants had previously suggested that they did not do any additional learning and/or CPD because they didn't have to, a finding mirrored in the first study where expert coaches cited peers in their sports being unwilling to travel for coach education opportunities and a lack of engagement with academic research as two examples of where learning opportunities were disregarded. It is worth noting that a high proportion of participants that completed the survey were remunerated in some way for their coaching (Figure 5d), in contrast to other studies into related topics, and this may also provide insight into why CPD opportunities were valued more highly by participants in this survey.

Coaches that participated in this study seem to share similar opinions of the role of NGBs, FHE and CPD in coach development regardless of experience, level or education background. Though not unanimous by any means, general consensus

appears to reinforce the idea that NGBs are best placed to service the coaching workforce in their sports, maintaining standards and ensuring that coaches are fit to practice through the design and delivery of entry-level qualifications (i.e., UKCC Levels 1 and 2 or equivalent). What is less clear is how additional sport science knowledge may be embedded into these qualifications, with participants suggesting that NGBs have limited appetite for this area at lower levels. Perhaps controversially, it is proposed elsewhere in this thesis that further and higher education should take a greater ownership and responsibility for Level 3 coach training with partnership and collaboration with NGBs an important feature of ensuring that sport coaches receive the correct level of sport science (and other coaching) knowledge to facilitate their advancement. Though intended solely as an approach for Continued Professional Development (CPD) the model proposed by Nash et al. (2017), where prescriptive training is replaced by more flexible and individualised education as the coach develops, might offer a useful starting point for how NGBs and FHE can work more collaboratively on coach training and education.

Summary of the Chapter

Using a mixed method survey approach, the second study discussed in this thesis sought to establish a better understanding of the location of sport science knowledge in coaching curricula, the actual and preferred methods of dissemination, and the role of National Governing Bodies (NGBs), further and higher education (FHE) and Continued Professional Development (CPD) in coach development. Participants revealed a variety of actual and preferred sources of sport science knowledge with digital sources (actual) and informal sources (preferred) the most popular (Figures 6a

and 6b). The extent to which digital/online resources and academic research literature were used was considerably higher than reported in previous studies, though some of this difference may be accounted for by the COVID-19 pandemic, increased availability of research literature outside of professional settings, a trend toward greater use of digital media over the past twenty years, or the educational background of the participants (who were mostly educated to a minimum of undergraduate degree standard). Greater use of digital resources may offset some of the perceived barriers associated with existing methods of coach development, namely availability, access and cost (Figure 6c).

Mirroring findings from the first study, as well as the extant literature investigating sources of knowledge, informal learning had high value placed on it by participants, reflecting the need to further explore how informal and non-formal learning can be recognised within frameworks designed to satisfy the requirements of a competent coaching workforce, perhaps adopting similar methods similar to those successfully used in the healthcare professions (HCPC, 2022) and the fitness industry (CIMSPA, 2022). Further discussion is required into the role that NGBs play in this, since some participants revealed these organisations to be a potential barrier to greater inclusion of sport science knowledge in the coaching curriculum, whilst further research may want to investigate levels of understanding and subsequent use of sport science knowledge by coaches in the field.

Survey participants recognised the value of sport science disciplines, with sport psychology and skill acquisition unanimously rated as being important to the coach in their role (Figure 7a). Similarly, a limited number of participants rated areas allied

to medicine as being important, though this may be due to coaches' being unable to use this knowledge in their day-to-day practice. Participants recognised the importance of a number of different sport science topic areas with only one (that of 'Enhanced Anaerobic Conditioning') being rated as unimportant by coaches with entry-level qualifications (routine experts). Other differences were identified in the level of importance given to topics by adaptive experts (those in possession of a UKCC Level 3 or equivalent coaching qualification), which is likely due to the degree that these experts understand what they need in order to be effective coach practitioners or because entry-level coaches have yet to be exposed to this type of knowledge in their NGB coach training.

No statistical differences were observed between routine and adaptive experts when exploring location of sport science topic, with a variety of responses across the sample regardless of experience, participant demographic, educational background and coaching qualification. It was hypothesised that this may be due to the moderating features of an individual's personal biography and the education background of the participants (who were mostly educated to undergraduate degree level or above). Given the range of coaches surveyed, it is proposed that sport science knowledge is introduced to lower levels of NGB coach training particularly in the areas of sport psychology and skill acquisition (Level 1) and training methods (Level 2) where applicable to the sport. A unique feature of this survey was the methods employed to determine location of sport science knowledge in the curriculum. Further larger-scale research may be warranted into the location of broader coaching knowledge topics in the coaching curriculum adopting this approach, using the

populations and domains proposed by the International and European Sport Coaching Frameworks (ICCE et al., 2013; Lara-Bercial et al., 2017) and similarly discussed by Hedlund et al. (2018) as a framework.

Thematic analysis of free-text responses to questions surrounding the role of NGBs, FHE and CPD recognised the important function of all of these in coach development. However, survey findings imply a diminished responsibility for NGBs in more advanced coach training (Level 3 and upwards) with collaboration and partnership with FHE being seen as integral to greater opportunities for coach development, as well as the need for further efforts to engage coach developers in approaches to learning that foster a more critical approach to coach education.

Limitations

Tanner (2018) suggests a number of challenges and issues associated with the use of descriptive surveys for data collection. Of these, *sampling and sample size*, *sources of bias and error* and *methods used* will be discussed in relation to this study.

Sampling and Sample Size

Surveys use a sample rather than a population, and the constraints of non-probability sampling often prevent generalisation to a wider population especially one with nuanced requirements (Tanner, 2018). Whilst the level of coaching qualification, employment status, and age of participants coached were consistent with other studies exploring the UK coaching workforce (e.g., Thompson et al., 2020), other key demographic characteristics of the sample such as proportion of coaches by gender, age and ethnicity were not. As such, the sample is more representative of a young,

White, Male, invasion game coach rather than a sport coach *per se*. This is likely owing to the networks used in recruiting participants, since these characteristics are reflective of sport higher education circles in the UK. For example, using the most recently published equality data from the author's employers at Sheffield Hallam University, only 6% of all sport students are mature, 11% are Black, Asian or Minority Ethnic (BAME), and 29% are Female. Whilst every effort was made to widen the recruitment beyond those networks familiar to the primary researcher, very few participants completed the survey from wider attempts to recruit such as through Facebook, LinkedIn and Strava (based on timeline data).

An important additional characteristic of the sample was their level of highest education achieved, with a high proportion of participants being educated at undergraduate degree level or above (84%). Though this statistic was not recorded in the UK Coaching surveys of 2017 and 2019 (Thompson & Mcilroy, 2017; Thompson et al., 2020), it is reasonable to assume that this level of education was also greater than the national average in the UK coaching workforce owing to the networks used to recruit participants. In some respects, this was a useful way of understanding a sample with more features of professionalism though this wasn't the intention.

Owing to observed discrepancies in demographics described above, great care was taken to not over-generalise the findings of the survey to a wider sport coaching population despite many of the findings being documented in previous larger-scale research, such as Williams and Kendall (2007b), Reade et al. (2008a), Kilic and Ince (2015), Stoszkowski and Collins (2016), and Nkala (2019). Were a similar study to be conducted in the future, a broader range of networks to recruit participants would

be needed or an alternative sampling method to improve the probability of a sample more reflective of the coaching workforce (e.g., Tanner, 2018).

Sources of Bias and Error

Survey research has several potential sources of error and bias that need to be acknowledged or controlled (Tanner, 2018). Of these, coverage error (when the sample does not fully represent the population) and sampling error (associated with the over-generalising of findings) are discussed in detail in the previous section. In addition, non-response errors are notable in this type of research. Non-response errors describe the disincentive to participate in a study, owing to other factors such as busy lifestyles, the volume of requests that participants receive or the poor design of the survey instrument (Dillman et al., 2009). Given that consultation on Sport England's Coaching Plan 2.0 took place immediately before this survey was circulated, and that many participants would have prioritised their contributions to this over a smaller-scale piece of research for a Doctorate, it is perhaps unsurprising that the sample size was small for the survey.

It is also likely that the survey encouraged responses from those that had 'something to say', a danger of adopting an approach to anonymity that this survey employed (Kirkby et al., 2011; Tanner, 2018) though this should be viewed as positive when previous research has suggested issues within some of the large organisations responsible for the regulation of standards within coaching (e.g. Piggott, 2012; Twitchen and Oakley, 2019).

Methods Used

Though the internet is widely acknowledged as a method to improve the data collection potential in social sciences, there is concern that an online population does not always represent an offline one (Feehan & Cobb, 2019). Amongst these concerns are the digital divide, referring to the unequal access of the internet in low socioeconomic and other under-represented groups, and the observation that increased access to the internet leads to improvements in education (Kho et al., 2018, cited in Feehan & Cobb, 2019). Because the survey was designed to consider opinions and views from a UK-based population, these concerns were offset to a certain extent by general agreement that the level of internet adoption in the UK is the best in the world (Feehan & Cobb, 2019). However, socioeconomic status data were not gathered in the survey and the number of participants that reported as BAME were also lower than the national average. The use of an online survey may account for these under-represented groups not featuring highly within the sample, and therefore represent a coverage error (Tanner, 2018) within the sample, though the timing of the survey data collection (amidst the later stages of the measures designed to reduce social interaction during the COVID-19 pandemic) make this an unintended consequence.

Final Thoughts and Recommendations

Conclusions

The aims of this thesis were to develop a better understanding of how coaches accessed sport science knowledge, barriers to implementation, and the role and function of education providers (namely National Governing Bodies, NGBs, and Further and Higher Education, FHE) in the development of coaches' knowledge in this area. As the research evolved, it became apparent that additional work was also needed to explore the location of sport science knowledge and topics in the sport coaching curriculum. As such, the thesis leans on a variety of different research and policy, including expertise and professional development, professional regulation and standards, knowledge and learning, and actual and preferred sources of knowledge.

It is important to make a distinction between coaches that *know* sport science and coaches that *do* sport science. The aims of the research were not to provide evidence to replace sport science practitioners with sport coaches better equipped to plan, deliver and evaluate sport science interventions. Rather, it was postulated that greater levels of sport science knowledge, and the reflection and learning that this increased knowledge might encourage, would have a positive impact on the ability of coaches to support their participants, regardless of level, age, or experience. For example, a better understanding of the Youth Physical Development (YPD) model (Lloyd et al., 2012) and the effects of growth and maturation could facilitate more appropriate programming of reactive agility with children and adolescents (e.g., Lloyd et al., 2013), as well as provide a platform for more informed discussions around the

applicability of Long-Term Athlete Development (LTAD) models to specific sports (e.g., van Kooten, 2016). Equally, in situations where sport science practitioners are collaborating with coaches in high-performance environments, greater knowledge could offer a coach more opportunities to work collaboratively with practitioners on addressing transdisciplinary athlete- and team-specific problems (e.g., Otte et al., 2020). Despite the differences in the circumstances described in these two situations, the parallels lie in the coaches' ability to make effective use of acquired knowledge (in this case, from the sport sciences) in maximising the potential of their participants.

A mixture of interviews with expert coaches (Study #1) and surveys with a wider range of coaches (Study #2) revealed a variety of different formal, non-formal and informal sport science knowledge sources in common with previous literature (e.g., Williams & Kendall, 2007a; Stoszkowski & Collins, 2016) and consistent with recent proposals to reform sport coach learning in the UK (UK Coaching, 2022). Central themes across both studies include the pervading belief that current approaches to formal education were often (though not consistently) inadequate but necessary, and that informal sources of knowledge were often used uncritically but preferred. A higher proportion of participants in the second study revealed digital formats as a source of knowledge when compared to previous literature, though this may be accounted for by COVID-19 social distancing measures in place when the second study was conducted, increased availability of academic research outside of professional settings, or greater acceptance of the internet as a credible source of information. Entry-level coaches may not possess a sufficient declarative knowledge base to critically evaluate or contextualise informal sport science learning through

peer discussion, networking, and communities of practice, emphasising the importance of well-trained facilitators and earlier introduction of sport science concepts to formal coach training. Greater understanding of how informal learning can be recognised and accredited is also needed, much in the same way that other professional vocations such as accountancy and nursing do so.

Consistent with literature examining the differences between sport coaches needs and sport science research (e.g., Williams & Kendall, 2007a; Reade et al., 2008b), expert coaches in the first study identified specialist language, lag between research and publication, and features of practitioners and coaches related to rapport, communication, open mindedness, and trust, as being the main challenges associated with sport science knowledge dissemination and translation. NGBs were identified as a barrier in both studies, suggesting the need for a re-evaluation of the role of these organisations in coach development, particularly at more advanced levels. Increased collaboration between NGBs and FHE at UKCC Level 3 was presented as a solution to concerns surrounding formal coach training and education. Furthermore, it was proposed that sport science education changes emphasis to encourage more transdisciplinary and interdisciplinary problem solving and greater development of soft skills within the curriculum. Equally, coach developers' confidence in use of more learner-centred approaches, similar to those employed in FHE (e.g., Ciampolini et al., 2019), would be of great benefit to the promotion of these approaches in NGB coach training.

It could be inferred from the findings of both studies that entry-level coach training contains insufficient sport science knowledge within its curriculum. This would

necessitate a re-evaluation of the core components of coach certification courses as well as CIMSPAs professional standards (CIMSPA, 2019, 2020), where sport science knowledge is only prevalent in higher-level environmental specialisms rather than in entry-level coaching specifications, though the development of an appropriate (and mandatory) CPD requirements in sport coaching could also address this need.

In common with literature examining expertise and professional development, the coaches from the first study displayed many features of adaptive expertise, including clarity of vision in determining knowledge needs and seeking out opportunities to learn from situations that present themselves (e.g., Schempp et al., 2006; Berry, 2020). This was substantiated by differences observed in the second study between adaptive (UKCC Levels 3 and above) and routine (UKCC Levels 1 and 2) expert coaches in their importance ratings of sport science topics. Further research is warranted into the stages and processes that expert coaches go through in assimilating, understanding, and using sport science knowledge in practice, using the coach learning model proposed by Stodter and Cushion (2017), an expertise model such as that proposed by Dreyfus and Dreyfus (2004), or building on work exploring adaptive expertise by Mees et al. (2020).

Findings from both studies broadly support literature calling for reforms in coach training and education that emphasise a shift towards more constructivist, learner-centred approaches, and that separate learning from assessment (e.g., Ciampolini et al., 2014; Paquette et al., 2018a; Paquette & Trudel, 2018b; Twitchen & Oakley, 2019). At time of writing, it is unclear what the role of different agencies will be in this reform (Sporting People, 2022b) but recent developments such as UK Coaching's

Coaching Learning Framework (UK Coaching, 2022), where athlete development, sport psychology and skill acquisition are all articulated as knowledge areas, and improvements in coach training taken by NGBs such as Volleyball (findings from the first study in this thesis, as well as Piggott, 2012) and reported by Twitchen and Oakley (2019) in Badminton and Hockey, where more constructivist approaches to coach learning are being used, are to be commended and recommended as good practice initiatives.

In light of ongoing consultation by the Government, what is also unclear is the role that Higher Technical Qualifications (HTQs) may play in the future of sport coach development. HTQs are part of a broader remit in place to reform higher technical education (HTE) in response to the Augur report (DfE, 2022), with HTQs viewed as a means to provide employers with a highly skilled workforce that correspond with professional standards approved by the Institute for Apprenticeships and Technical Education (IATE). Significantly, HTQs are designed to be delivered at Levels 4 and 5 (i.e., first and second year undergraduate degree level) and it is the professional standards published by CIMSPA (2019, 2020) previously discussed in this thesis that such courses will be mapped against. Though it is unclear what employer demand exists for sport coaches qualified at HTQ level, not to mention criticisms placed on university's delivering on-demand courses to satisfy immediate workforce demands in sport and physical activity (Aldous & Brown, 2021), this policy initiative is welcomed by the author and supported by the findings in this thesis that propose Level 3-qualified coaches should possess (sport science) knowledge and skills at undergraduate degree level. It will be interesting to see how CIMSPAs approach to

the endorsement of undergraduate degrees unfolds in conjunction with this. The rationale behind HTQs also seems to contradict, or at least be incompatible with, the downplaying of the professionalisation of sport coaching between Sport England's *Coaching in an active nation* (Sport England, 2016) and *Uniting the Movement* (Sport England, 2021b), though it remains to be seen what the Coaching Plan 2.0 will look like when published later in 2022.

Findings in this thesis support the suggestion of Stodter and Cushion (Stodter, 2014; Stodter & Cushion, 2017) that personal biographies, such as previous experience as an athlete and belief systems, and an openness to innovative ideas both function as filters through which new knowledge is processed, and ultimately adopted or dismissed. Though level of expertise and type of participants coached may logically offer contextual justification for coaches to accept or discard sport science knowledge, this was not the case in this thesis. This may be due to the educational background of the participants in both studies, who were at or above undergraduate degree level and suggests that approaches to learning favoured in FHE provide an appropriate platform for sport coaches to make informed decisions about knowledge and its meaning to their coaching practice.

Recommendations

Based on the findings of this thesis and the ensuing discussion that has unfolded, four recommendations are made to enhance coaches' access and use of sport science knowledge, namely:

1. A review of coach training and education needs

2. Closer collaboration between further and higher education (FHE) and National Governing Bodies (NGBs) in the development of sport coaching curricula at UKCC Level 3

3. Increased attention to the development of soft skills in sport science practitioner training

4. Further work developing a framework for coach developers' best practice

Review of Coach Training and Education Needs

Many of the findings in this thesis point to a general malaise and discontent towards existing National Governing Body (NGB) coach training, those this was not unanimous, and pockets of good practice were highlighted in some sports as well as in existing literature examining coach training. As such, a thorough review of coach training and education needs, specifically surrounding coach certification and continued professional development requirements for entry-level coaching is recommended. Policy shifts related to Higher Technical Education, and subsequent formation of Higher Technical Qualifications (DfE, 2022), and adoption of CIMSPAs professional standards (CIMSPA, 2022), provide insight into the trajectory of advanced levels of sport coaching in the UK, but it is less clear how sport coaching designed to service participation and activity needs in a mostly voluntary coaching workforce will be supported and developed. Given the emphasis of this thesis on sport science knowledge, it is recommended that curriculum frameworks such as those proposed by Hedlund et al. (2018), who use population and knowledge domains identified in the International and European Sport Coaching Frameworks (ISCF and ESCF: ICCE et al., 2013; Lara-Bercial et al., 2017), are used as a catalyst for

this discussion. Understanding the role of formal and informal learning opportunities in coach development is also required as part of this and is consistent with requests for reform in coach education by Nash and Collins (2006), Twitchen and Oakley (2019), and Cushion et al. (2021), and reflecting specific recommendations made by Ciampolini et al. (2014) and Paquette and Trudel (2018b).

A shift toward more learner-centred approaches encouraging guided discovery in coach training are welcomed, as is the use of in-situ assessment, as suggested in Sport England's (2016) *Coaching Plan for England*. However, there is limited longitudinal research examining the impact of formal coach training on changes to practice, with many studies reporting inconclusive results (e.g., Jones & Allison, 2014; Stodter, 2014). A useful heuristic to consider this may be the coach learning model designed by Stodter (2014; Stodter & Cushion, 2017), and provides an evidence-informed, sport coaching-specific framework to base such research on. The second study in this thesis employed a unique approach to understanding knowledge needs by surveying coaches on how they rated the importance and location of sport science topics in the coaching curriculum, and a study of larger magnitude adopting a similar approach may be useful for coach training and education providers to better understand the immediate needs of their workforce whilst larger reforms are ongoing.

Closer Collaboration between NGBs and FHE

Findings in this study suggest the need for coach educators/developers and sport science practitioners to reconsider how complex sport science terminology is used within coach training, CPD, and more broadly in informal coach-practitioner conversations. Though it has been previously acknowledged that fluency in this

language is required by coaches in preparation for higher levels of working (Martindale and Nash, 2013), and the ability to read and understand academic research has been highlighted as a key characteristic of high-performance coaches (Williams & Kendall, 2007a), further discussion is required as to how and when this terminology is introduced to sport coaching curricula.

Despite the suggestion in this thesis that education background acted as an important mediating factor in coaches' decision-making surrounding learning opportunities, and indications in the first study that expert coaches felt degree-level qualifications in sport coaching or related disciplines should be viewed as a minimum requirement for expert coaches, it is not the intention to recommend that *all* sport coaches possess these qualifications to better understand the complex language used in the sport sciences. Rather, it is suggested that further and higher education institutions are well-placed to identify the needs of NGBs and to support the appropriate design of courses, modules and other learning opportunities for coaches regardless of their ambitions or level. Furthermore, it is proposed that the contribution of FHE is greater at UKCC Level 3 or equivalent. Though Level 3 is aligned to undergraduate degree level knowledge in the ISCF and ESCF, there are no formal expectations that Level 3 coaches should be in possession of an undergraduate degree. For sport coaching to be considered a profession, with many suggesting that it is not (e.g., Nash et al., 2017), it is argued that this should be a continued ambition for the future despite the downplaying of certain aspects of sport coach professionalisation in recent policy changes (e.g., Sport England, 2021).

As implied elsewhere in this thesis, one approach to coach development reform may be the diminished responsibility of NGBs in UKCC Levels 3 and 4. Though controversial, this could take the form of a coach development system where all Level 3 candidates (regardless of sport) are educated together on programmes of study, with NGBs administering the in-situ assessment aspects and FHE designing and delivering the curriculum. Given the forthcoming introduction of HTQs in sport coaching, it is inevitable that collaboration of this type will take place for these higher levels of coaching though consideration of access, flexibility and mode of delivery should all feature in these discussions (see Nelson et al., 2013; DfE, 2022). The roles of the different agencies in this (particularly CIMSPA, ICCE, UK Coaching and NGBs) is still unclear, but it would be encouraging to see greater contribution from the FHE sector in these conversations.

Developing Soft Skills in Sport Science Practitioners

The findings presented here support the contention that soft skills, such as rapport building and contextual communication skills, are often absent in less-experienced sport science practitioners. The current method of quality assuring Sport and Exercise Science degrees in the UK, the BASES Undergraduate Endorsement Scheme (BUES; BASES, 2019) sets out *professional development and practice* and *employability and career readiness* as two of its pillars. However, the emphasis within the application process is very much centred on demonstrating that graduates of endorsed degree programmes possess knowledge and technical competencies in the core sciences of physiology, psychology, and biomechanics (BASES, 2019), rather than on the

complimentary skills required to successfully translate and apply these knowledge and skills to sport and physical activity settings.

In recognising some of the challenges associated with successful knowledge translation from the sport sciences into high-performance sport, Bartlett and Drust (2020) propose a framework of delivery centred on evidence-based practice, philosophy, stakeholders, and facilitation. Arguing that many of the soft skills that are developed on undergraduate degrees are not fit for purpose when particularly applied to a high-performance sport setting, the authors present their 'Do You Know' schematic (Bartlett and Drust, 2020, pg. 7) as a useful way to envision this, with the interpersonal craft of the sport science practitioner (i.e., relationship building, communication etc.) at the centre of practitioner development. Echoing the findings from this study, they suggest in most cases that it is the soft skills of the practitioner that will ultimately lead to successful transfer of knowledge, rather than the level of knowledge or technical skill that the practitioner possesses.

As such, it is recommended that the development of these skills should form a larger and more important part of both undergraduate degrees and in-service training for aspiring sport science practitioners. This may be through work-based learning opportunities, such as internships (Malone, 2017), or through postgraduate scholarship programmes (McGuigan and Rowell, 2018), rather than as part of undergraduate degree programmes. Echoing discussion in this thesis surrounding partnerships between NGBs and FHE to improve sport coach development, it would be sensible to suggest that such collaboration also forms part of these curriculum reform discussions. It is not lost on the author that sport coaching has become a

marginalised subject area in a large number of undergraduate Sport and Exercise Science degree programmes around the UK, with areas such as performance analysis and strength and conditioning taking its place and that this may be a sensible and pragmatic solution to develop better understanding of coach-athlete relationships and the sporting environment for aspiring sport science practitioners.

Notwithstanding potential barriers such as staff buy in and funding (Malone et al., 2019), problems associated with different objectives from collaborative research (Coutts, 2016, and Wulf, 2012), and the observations in this study that coaches prefer informal sharing over more formal means such as peer-review publication, much can still be learnt from closer collaboration between sport coaches and sport science practitioners on applied research problems. One possible method of achieving this could be through the previously discussed collaboration between FHE and NGBs in the design of coach education opportunities. Closer working relationships between research-active academics and those responsible for coach development in NGBs may naturally lead to collaboration on sport- and coach-specific problems. The author suggests that it would be of value if research into coach education and development adopted an implementation science approach. Though a new and emerging field, broadly speaking implementation science is designed specifically to reduce the gap between theory and practice, by understanding interventions (in this case, coach education and CPD) in context, and by engaging end-users in the implementation activities in order to facilitate changes in attitudes and behaviours (Fixsen, 2005). To-date, there are no examples of research employing an implementation science

approach in sport coaching despite the recognised advantages of this approach in other facets of sport (Donaldson and Finch, 2013).

Enhancing Coach Developers' Practice

This thesis supports the view that the instructor/coach developer[6] has an integral part to play in fostering the right learning environment for sport coaches to benefit most from formal learning opportunities. The limited amount of research available emphasises the challenges faced by coach developers in attempting to deploy more constructivist, learner-centred approaches to coach learning (e.g., Stodter & Cushion, 2019), and reinforces a power dynamic between instructor and learner that has the potential to foster indoctrination and uncritical application of knowledge (Downham & Cushion, 2020). The effectiveness of mentoring (e.g., Jones et al., 2009), critical networks (e.g., Piggott, 2012), communities of practice (e.g., Garner & Hill, 2017) and approaches to learning employed by educators (e.g., Ciampolini et al., 2019) are all worthy of additional research tailored towards examining the role of the instructor in coach learning.

Those responsible for the administration and design of coach development programmes at the level of the sport are encouraged to familiarise themselves with the constructivist learning approaches promoted by those calling for coach development reform (e.g., Twitchen & Oakley, 2019) and endorsed by recent policy changes (e.g., Sport England, 2021). This will naturally lead to evidence-informed decisions about the make-up of the coach developer workforce and may involve

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[6] Widely referred to as the *facilitator* by the ICCE and *tutor* by UK Coaching and NGBs

adoption of an approach that evolves from being more prescriptive in entry-level qualifications to more learner-centred as the coach develops (e.g., Nash et al., 2017). Dispositions to coaching have been shown to be stable and difficult to change regardless of training (e.g., Webb & Leeder, 2021) and the same is true of coach developers (Paquette & Trudel, 2018b), inferring that there may be coach developers not suited to coach training beyond the entry level. This will only happen if NGBs are more open to outside influence, though this may happen as a direct result of the UK Government's newly published approach to higher technical education (DfE, 2022) in due course. The findings and recommendations of this study mirror the proposals of Paquette and Trudel (2018b), who present recommendations on how to overcome many of the current shortcomings of formal coach training and education, including the adoption of a learner-centred teaching framework, increased training for facilitators and the prioritisation of meaningful content, are implemented.

This research offers a contemporary insight into how UK sport coaches perceive and access sport science knowledge, identifies barriers to greater implementation across different sport coaching settings, and provides further stimulus for the continued and timely debate surrounding the role and function of National Governing Bodies and further and higher education in coach development and learning. Recommendations include gaining a better understanding of the immediate knowledge needs of sport coaches, greater ownership of coach training and education by further and higher education, changes in the sport science curriculum to better reflect relationship skills, and further effort devoted to the enhancement of training in coach developers.

Reflections on the Journey: Speed Bumps and Curveballs

This Chapter aims to locate my position as a researcher and evaluate my journey through this process in a professional context. Specifically, I will try to contextualise and reflect on the learning that has informed my decisions, challenged my identity, and influenced my thinking on how my role as a leader in sport higher education has changed in relation to the learning, training and development of sports coaches. Broadly speaking, research interpretation is bounded by situated rationalities; in this context, the journey taken is as important as the starting position (conducting a piece of original research intended to further explore an area of professional interest) and/or end position (submission of a thesis that is examined to determine its eligibility for a Doctorate of Professional Studies, DProf). As such, this account will start with an evaluation of changes in my personal and professional circumstances, as these have shaped my approach to the design and construction of this body of work and informed the interpretation of the findings from the studies detailed in this thesis. I will then proceed to discuss the professional learning that has arisen from undertaking the Doctorate of Professional Studies (DProf), adopting the 'required reflection' approach that accompanies such a programme of study (Cunningham, 2018).

Then (1975-c.2011)

Much of my interaction with sport in my early career was as a sport science practitioner, employed specifically to manage and lead the support services being provided to the organisation (usually a high-performance sports team or group of athletes), with the sole aim of maximising their return on investment through

expediting athletes from the injured to the not-so-injured list. Furthermore, though I was employed to undertake this function in these organisations, it was not my primary vocational responsibility, which was as a Senior Lecturer and Course Leader for one of the UKs largest undergraduate Sport and Exercise Science degree programmes at Sheffield Hallam University (SHU). Most, if not all, my involvement with high-performance sport was as a 'sub-contractor', where the sport/team employed the University, who then deployed me to manage the relationship alongside my existing responsibilities in and out of the classroom.

One of the turning points in my career was the realisation that my early ambition to be a full-time sport science practitioner was not going to be fulfilling in the longer term. A large part of the conflict was a tension between personal and professional values where, at times, I was faced with making immoral (or at least questionable) decisions about the welfare of the athletes to satisfy the needs of the coaches that I worked with. That much of these experiences were in the 'self-imploding' sport of Rugby League (Kilmurray, 2010) further reinforces the challenges that I faced. It was the internal dialogue that accompanied this, the many sleepless nights, and the realisation that there were boundaries I was unwilling to cross, that led me to enrolling on the DProf programme, though I didn't realise this at the time.

My path to enrolling on the programme was the result of unwavering belief that there was something 'not right' about my role working in an applied sport science setting, especially when the coaches I worked with were either resistant to change or had limited understanding/appreciation of what sport science had to offer. I had worked hard to build rapport, did the 'hard yards' to engender trust and foster some

empathy, but was still not making the difference that I thought I could (dare I say, should). This culminated in me 'retiring' from working in the field of applied sport science, began actively pursuing roles in Higher Education management and leadership (a logical step, given my experience to-date), and formulating ways that I could design a programme of research that explored coaches' perceptions and access to sport science knowledge; I wanted to know more about how and why the resistance that I had observed was so prevalent.

At this stage, despite enrolling on the programme, I had no real interest in competing a Doctorate. Whilst I have always appreciated the value (in terms of 'academic currency', e.g., Pertuz-Peralta et al., 2020) of a PhD or similar, a large part of this disinterest was because I did not perceive myself as being an 'expert'. From very early on in my undergraduate degree (c. 1996), though I can't explain why, I became interested in an interdisciplinary approach to sport science (e.g., Burwitz et al., 1998; Otte et al., 2020), where the appropriate selection, utilisation and application of knowledge and skills from the sport sciences outweighed the importance of a clearly defined role. By looking to understand complex problems that could not be easily categorised or classified into monodisciplinary topics, I became committed to a set of curiosity-driven habits that culminated in an interest that could not easily be distilled into an area of study. I had deconstructed sport science from the recognisable scientific disciplines into an approach which fostered a better understanding of my surroundings in higher education and sport, but not well-positioned to begin a doctorate. Kolic (2019) describes a period of transmigration as she embarked on a qualitative research programme surrounded by colleagues undertaking quantitative

research, whilst I was an interdisciplinarian in a world of mono-disciplinarians. Though not the same, the sentiments and feelings of insecurity and loneliness are analogous with those described by Kolic.

I always felt like I did not belong in higher education. Wright (2016; also Bothello & Roulet, 2019, and Wilkinson, 2020) describes the feeling of being an 'accidental academic' perfectly in her autoethnographic article about how certain converging life experiences led her to being in full-time academia. The parallels to how I ended up as a full-time academic, who started lecturing to fund the completion of a Masters by Research rather than with a specific goal in mind, are uncanny. This sense of perceived misrepresentation led to a sense that I did not merit the status or rewards that I received as a full-time lecturer and certainly did not give me the confidence to initiate Level 8 study.

On a personal level, I also found most academic colleagues who had embarked on research careers to be too narcissistic and selfish for my taste, substantiated by the observation that these colleagues were not that interested in our students. As someone that has always had roles centred on the development and maintenance of student experience, this never sat comfortably with me, even though I recognised the strategic qualities that such behaviours, at least in the form of organisational narcissism, brought to the higher education environment (Cragun et al., 2019). As such, I had good reason (both professionally and personally) to tread carefully, and with some reticence, into the world of research.

The Journey (2011-2021)

I enrolled on the programme in 2011 and, having made the decision to adjust my career ambitions, was promoted to Principal Lecturer as Learning Teaching and Assessment Lead in 2015. Given the distraction that high-performance sport had been in the early stages of my career, I was justifiably proud that I had achieved a promotion, timely too given the financial cost of tuition fees and cost of living in Sheffield (where I had moved shortly after getting a job there in 2005), and began to feel more comfortable in my surroundings, despite the misgivings about self and worth described previously in this account. The initial stages of the DProf programme between 2011 and around this time were met with enthusiasm. Though I did not know what my research topic would be, I was comfortable with the work and, though I did not find the teaching on the programme particularly inspirational or enlightening, I did successfully complete the modular components of the DProf, albeit with a temporary suspension of my studies in 2014 when I got married. A few weeks after I was promoted, a further (far more notable and important) distraction was presented in the form of a bouncing baby boy, my first-born son Jacob, in May 2015. As such, the period between 2011 and 2015 were largely successful. Williams (2013) describes the 'spinning plates' required to complete a doctorate, and my personal and professional life were no different. Newly married, an imminent addition to the family, a promotion, and the research part of the DProf programme were all receiving attention. Barnett (2008) refers to the additional 'supercomplexity' (pg. 190) of professional doctorates as adding to the myriad of demands already placed on busy professionals, and my life was no different in that regard.

Despite the welcome news that a second baby was on the way in late 2017 (Imogen arrived safely in April 2018), the 'wheels started to come off'. A period of uncertainty and restructure within my department at leadership level, coupled with an unhealthy (and mutual) distrust of the newly appointed Head of Department, led to a period of mental health issues that left me feeling worthless, miserable, and demotivated. Though there is some evidence to suggest that distrust shares cognitive commonalities with creativity, the detrimental effect that suspicion and distrust had on my creative flow were crippling (e.g., Mayer & Mussweiler, 2011).

After a six-month absence from work, and a further suspension in my studies that accompanied this unwanted sabbatical, I returned in a new role. The irony is not lost on me that this new role (as Subject Group Leader for Physical Education and Sport Coaching) brought me closer to my chosen research topic of interest, but as a sports coach rather than as a sport science practitioner. The change, like the sabbatical, was unwanted but timely. Though wrongly attributed to Freud, the quote 'Out of your vulnerabilities will come your strength' seems apt in describing the uncharacteristic clarity that came from having to forensically assess, evaluate and understand the courses in my new portfolio, including undergraduate and postgraduate degrees in sport coaching.

Low rates of doctoral completion are a major concern in the UK, with estimates of completion ranging from 50% to 83%, as is the length of time it takes to complete (Andriopoulou & Prowse, 2020). This may be due to the elevated levels of psychological distress, mental illness and burnout that are reported in doctoral students (e.g., Scott & Takarangi, 2019). Furthermore, Sverdlik et al. (2018) report

the student-supervisor relationship as being the most widely researched factor influencing successful completion of doctoral programmes observing that open, supportive, and frequent communication with supervisors is an essential aspect of successful completion. Though I am not suggesting that there is a correlation between the two, I did suffer from a carousel of Directors of Study (I count four) throughout the course of the DProf.

Now (c.2021-22): Lessons Learnt

Implicit in the definition of a Doctorate of Professional Studies is that it will develop the capability of individuals to work within their professional domain (UK Council for Graduate Education, 2002). As such, it is implied that successful completion of a programme of study such as the one outlined in this thesis will make differences to the individual at a personal and professional level (Creaton & Anderson, 2021). In the process of reflecting on this journey, I have come to accept a number of changes in personal and professional outlook that I maybe hadn't fully realised before writing this reflexive account.

Barriers previously discussed, such as sense that I didn't belong in academia, coupled with a truculent attitude towards research, have done me no favours. Despite evidence to the contrary, my overriding position was that of an academic misfit and there were times in the past decade where I feel as though I have self-sabotaged my own progress to validate that. Whilst there are a number of interventions that could have been taken by those responsible for the leadership of the DProf programme, particularly around duty of care for doctoral students when I was absent through illness and physical injury (I had approximately six months off work for two surgical

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procedures during this period as well as the previously discussed six-month absence owing to poor mental health), an example of this was my avoidance of addressing concerns surrounding supervisors not commenting on my writing. I could have helped myself to achieve more through investigating supervisors for goodness of fit, been more open and transparent about my own expectations, and contributed more to the student research community (as identified by Duke & Denicolo, 2017) whilst also taking greater advantage of research supervision by being more assertive about the level of engagement on earlier drafts of the work (Smith, 2008).

Notwithstanding these observations, a benefit to have come from this experience has been my approach to supervision of undergraduate and postgraduate student dissertations. Although I have always taken a humanistic approach to dissertation supervision, where I have tried to look at the research project through the eyes of my students rather than adopting a one-size-fits-all/'My way or the highway' approach, I have noticed a change in approach to setting boundaries and targets with my students that has facilitated better relationships and improved their confidence. This has been particularly true during the pandemic, when students had to become accustomed to supervision meetings via video conference and a pivot to systematic reviews as a dissertation mode when data collection was deemed unsafe.

Though questions have been raised about whether DProfs make an impact on professional practice and/or changes in the workplace (Mellors-Bourne et al., 2016), an important characteristic of this period has been how my own practice as an advocate and academic leader in sport coaching has evolved, as well as the practical effect of how new knowledge and understanding is deployed in an organisational

context (Creaton & Anderson, 2021). The findings of my thesis have reinforced the belief that undergraduate sport coaching degrees are a valuable way to enhance knowledge and practice in future leaders and practitioners in the field of sport coaching. Consistent with the literature exploring differences between graduate and non-graduate coaches (e.g., Stonebridge & Cushion, 2018), it is evident in my findings that tertiary education is a vital component in coach learning and development though particularly at advanced levels of coaching. At the coal face, it has led to a change in focus of my teaching, with a shift in emphasis away from cramming the curriculum with knowledge to one that fosters independent learning and encourages learners to seek out their own version of the 'truth', particularly with postgraduate students.

My default view on sport coaches has changed during this process, too. Going into this research, I was firmly of the view that 'coaches were wrong'; that is to say, sport coaches lacked the knowledge and skills to apply my 'stuff' (i.e., sport science) effectively. Whilst some of the research findings have suggested this is true to a degree, there is no question that the role and function of sport science practitioners (not to mention National Governing Bodies of sport) should have been my primary focus of attention – we (though I wouldn't consider myself part of the we, anymore) were a large part of the problem. As someone that led the last validation of the Sport and Exercise Science degree at SHU in c.2017 during my tenure as Course Leader, I look back at the removal of sport coaching as an optional pathway with regret and embarrassment, despite market forces clearly being in the favour of replacing this subject with other contemporary disciplines of sport science, such as performance

analysis. There is a clear need for sport science practitioners to possess greater practice empathy, and so I am lobbying hard for the re-inclusion of sport coaching in the sport science curriculum as SHU enter a period of portfolio review and validation.

Having been responsible for the successful application to be a higher education partner of the Chartered Institute for the Management of Sport and Physical Activity (CIMSPA), and with a key role in the design of the upcoming Higher Technical Qualification in sport coaching at SHU, the synergies between my research and practice have been profound. There is no question that this research has featured heavily in my advocacy at leadership level about CIMSPA partnership and being able to report some of the findings as rationale for the resource outlay has been gratifying. I owe a great debt to my examiners for facilitating my navigation through the different organisations and agencies involved in the professionalisation of sport coaching in the UK, since without their intervention I would have been firmly 'on the fence' around CIMSPA and their contribution.

What Next?

My objectives moving forward are to use the underlying knowledge developed from completing this thesis to implement a redesign of our undergraduate and postgraduate degrees in sport coaching, in line with the department's portfolio review and institution-wide reforms in curriculum design and structure. In particular, the findings of the second study will be used in designing the core knowledge components of coaching science curricula, as will the work of Hedlund et al. (2018) and the ICCE bachelor degree standards. I will also look to publish the findings of each study, both in academic and professional literature.

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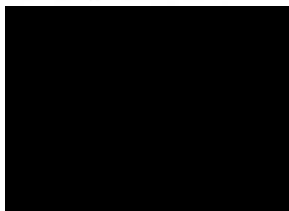Yin, R.K. (2011). *Qualitative Research from Start to Finish.* The Guildford Press.

Appendix A: Ethical Approval for Study #1

Sheffield Hallam University

Secretary and Registrar's Directorate
City Campus Howard Street
Sheffield S1 1WB

GT/RDSC
21 September 2015

Tel no: ███████████
E-mail: ███████████

Dear Mr Kingsbury

Application for Approval of Research Project and Supervisory Team

Your application for approval of research programme was considered by the Chair of the Research Degrees Sub-Committee on 21 September 2015 and I am pleased to inform you that it was approved. Please find attached rapporteurs' comments for your information.

The next stage for you will be the Approval of the Examiners and Doctorate Project Report title for Award of the Doctorate in Professional Studies. These details should be proposed on form DPS3 by your Director of Studies, and submitted to the Graduate Studies Team at least 4 months in advance of submission of your doctoral project report. In your case we would expect to receive a DPS3 no later than 1 May 2019, you will no doubt wish to discuss this with your Director of Studies. Your registration details are also attached.

If you have any queries, please contact Student Systems and Records (Research Degrees) based at City Campus, using the contact details above.

Yours sincerely

Appendix B: Informed Consent Form for Study #1

Sheffield Hallam University

Coaches' experiences and perspectives of sport science

support in high-performance sport:

Informed Consent Form

Please answer the following questions by ticking the response that applies

		YES	NO
1.	I have read the Information Sheet for this study and have had details of the study explained to me	[ ]	[ ]
2.	My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any point	[ ]	[ ]
3.	I understand that I am free to withdraw from the study within the time limits outlined in the Information Sheet, without giving a reason for my withdrawal or to decline to answer any particular questions in the study without any consequences to my future treatment by the researcher	[ ]	[ ]
4.	I agree to provide information to the researchers under the conditions of confidentiality set out in the Information Sheet	[ ]	[ ]
5.	I wish to participate in the study under the conditions set out in the Information Sheet	[ ]	[ ]
6.	I consent to the information collected for the purposes of this research study, once anonymised (so that I cannot be identified), to be used for any other research purposes	[ ]	[ ]

Participant's Signature: .... Date: ..... / ..... / .....

Participant's Name (Printed): ....

Contact details: ....

....

Researcher's Signature: ████████████   Researcher's Name: Damian Kingsbury

Researcher's contact details: ████████

Academy of Sport and Physical Activity
Sheffield Hallam University
A129 Collegiate Hall
Collegiate Crescent
Sheffield S10 2BP

E: ████████████

Please keep your copy of the consent form and the information sheet together

Appendix C: Interview Guide for Study #1

Background

Briefly outline your experiences of working in a high-performance sporting environment

How have these experiences shaped your philosophy of practice?

Priorities
In your opinion, what are the current priorities for applied sport science research?

Following on from this, what are the future priorities for research and how/why have these changed?

Barriers

Are there any barriers that prevent sport science research from being employed more effectively by coaches?

What do you think could be done to improve the situation?

Qualities

As far as applied sport science practice is concerned, what are the qualities valued most by you as a high-performance coach?

Likewise, what do you think are the qualities valued most by coaches in practitioners?

Communication

Which methods of research presentation do you think would most benefit the high-performance sporting environment?

What are the barriers that prevent you from doing this with your data?

Translation

How do you employ research findings in your day-to-day practice?

What, if any, are the barriers to effective implementation of these findings?

Any

Is there anything else that you would like to add?

Appendix D: Ethical Approval for Study #2

Status change comment
DO NOT WRITE ANYTHING IN THIS NOTES BOX AS IT CAN BE SEEN BY ALL OTHER USERS. Proceed to select the
workflow status and click Done.

- Dear Damian

Title of Ethics Review: Sports coaches' perceptions of and access to sport science in preparing athletes
Ethic Review ID: ER36179799

The University has reviewed your ethics application named above and can confirm that the project has been
approved.

You are expected to deliver the project in accordance with the University's research ethics and integrity policies and
procedureshttps://www.shu.ac.uk/research/ethics-integrity-and-practice.

As the Principal Investigator you are responsible for monitoring the project on an ongoing basis and ensuring that
the approved documentation is used. The project may be audited by the University during or after its lifetime.

Should any changes to the delivery of the project be required, you are required to submit an amendment for review.

Wishing you success you with your study

Kind regards,
Ethics Research Support

*** This is an automatically generated email, please do not reply ***

1

Appendix E: Survey Used for Study #2

Preamble[7]

As part of a Doctorate of Professional Studies (DProf), I am conducting a study examining your needs as a coach related to the different topics of sport science. The findings generated from the study will provide information that could lead to improvements in the delivery and application of sport science content on coach training and education in a variety of settings.

Responses will be kept in the strictest confidence. Your name is not required, and your identity will not be known (though there is an opportunity for you provide contact details should you wish to be involved in any future research exploring this topic).

Results will be reported as group data only. The survey should take approximately 30-45 minutes to complete. Your time and effort is greatly appreciated.

Damian Kingsbury (Researcher)

Participant Information

Title of Project: Sports coaches' perceptions of and access to sport science in preparing athletes

Legal basis for research for studies: The University undertakes research as part of its function for the community under its legal status. Data protection allows us to use personal data for research with appropriate safeguards in place under the legal basis of public tasks that are in the public interest. A full statement of your rights can be found at: www.shu.ac.uk/about-this-website/privacy-policy/privacy-notices/privacy-notice-for-research. However, all University research is reviewed to ensure that participants are treated appropriately, and their rights respected. This study was approved by UREC with Converis number ER36179799.

Further information at: www.shu.ac.uk/research/excellence/ethics-and-integrity

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[7] The survey has been partially modified for illustrative purposes, owing to the difficulties migrating Google Form surveys from HTML to Microsoft Word; original version can be found here:

https://docs.google.com/forms/d/e/1FAIpQLSeAaj4RidkQ7A7HvCtujZhGM_OwWjw2X0iiAsstbuWXvsj4RQ/viewform

Why have you been asked to participate? As someone involved with coaching or guiding sport or physical activity, you have been approached to participate in a study exploring your needs as a coach and the different topics of sport science.

What will you be asked to do? If you choose to volunteer, your contribution will consist of the completion of this online survey that will take approximately 30-45 minutes to complete. The survey consists of questions around your background in coaching, what your views of sport science (as they relate to your coaching) are, and your views on the role of National Governing Bodies (NGBs) and Further and Higher Education (FHE) in coach learning and development.

How long will the study last? The study is planned over three months, between December 2021 and February 2022 with a write-up period to follow.

Who is responsible for the information, and what will happen to it? After the survey, the lead researcher will be responsible for the raw data (your answers to the survey questions). Anonymity is really important. As such, you do not have to identify yourself when completing the study (see 'Will anyone be able to connect you to the study?' below for further details).

How will the findings be used? This study is for the award of Doctorate of Professional Studies (DProf). As such, the primary purpose of the data collection is to be written up in a thesis format. In addition, it is likely that the findings of the study will be presented at a scientific conference, published in a peer review journal and/or in a National Governing Body magazine. For the purposes of further publication, anonymised data will be kept in a secure location until publication. At this point, the data will also be destroyed.

Will anyone be able to connect you to the study? As previously mentioned, anonymity is really important. Answers that contain information that might lead a reviewer to conclude who you are, such as your sport, will be removed from the data. All issues pertaining to the Data Protection Act will also be applied.

How can I find out about the results of the study? If you would like a copy of the thesis, please do not hesitate to contact me and I will provide you with an electronic (PDF) copy once the final Doctoral examination has taken place (likely to be in the Summer of 2022).

What if I do not wish to take part, or if I change my mind? This study is voluntary. As such, participation is totally at your discretion. You are free to withdraw at any time. Please consider asking follow-up questions first prior to making a decision to not take part or withdraw.

How do I get any questions answered? Feel free to contact me by e-mail (d.kingsbury@shu.ac.uk) if you have any further questions or need clarification of any of the explanation provided above. Please provide a telephone number and try to identify suitable (i.e., convenient) timeslots for a return call.

If there is a problem? Please do not hesitate to contact my Director of Studies, Dr Alison Purvis (a.purvis@shu.ac.uk), if you would like to discuss any aspect of this study with someone else. Equally, I can be contacted at d.kingsbury@shu.ac.uk

Informed Consent

Once you have read the Further Information provided, and have had any questions answered satisfactorily, please tick each of the statements below *(Select all that apply)*

☐ I have read the Further Information for this study and have had details of the study explained to me

☐ My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any point

☐ I understand that I am free to withdraw from the study within the time limits outlined in the Information Sheet, without giving a reason for my withdrawal or to decline to answer any particular questions in the study without any consequences to my future treatment by the researcher

☐ I agree to provide information to the researchers under the conditions of confidentiality set out in Further Information

☐ I wish to participate in the study under the conditions set out in Further Information

☐ I consent to the information collected for the purposes of this research study to be used for any other research purposes

Background

1. What gender do you identify as? (*Select only one option*)
☐   Male
☐   Female
☐   Non-Binary
☐   Prefer not to say

2. Please indicate the age bracket that you are in (*Select only one option*)
☐   18-24
☐   25-34
☐   35-44

- ☐ 45-54
- ☐ 55-64
- ☐ 65+

3. What ethnicity/race do you identify with? (a follow-up question will allow you to specify in more detail) (*Select only one option*)
- ☐ White (*Skip to Question 3a*)
- ☐ Mixed or Multiple Ethnic background (*Skip to Question 3b*)
- ☐ Asian or Asian British (*Skip to Question 3c*)
- ☐ Black, African, Caribbean or Black British (*Skip to Question 3d*)
- ☐ Other Ethnic Group (*Skip to Question 3e*)

3a. White Ethnicity. Please provide further details (*Select only one option*)
- ☐ English, Welsh, Scottish, Northern Irish or British
- ☐ Irish
- ☐ Gypsy or Irish Traveller
- ☐ Any other White background
- ☐ Prefer not to say

Skip to Question 4

3b. Mixed or Multiple Ethnicity. Please provide further details (*Select only one option*)
- ☐ White and Black Caribbean
- ☐ White and Black African
- ☐ White and Asian
- ☐ Any other Mixed or Multiple ethnic background
- ☐ Prefer not to say

Skip to Question 4

3c. Asian or Asian British Ethnicity. Please provide further details (*Select only one option*)
- ☐ Indian
- ☐ Pakistani
- ☐ Bangladeshi
- ☐ Chinese
- ☐ Any other Asian background
- ☐ Prefer not to say

Skip to Question 4

3d. Black, African, Caribbean or Black British Ethnicity. Please provide further details (*Select only one option*)
- ☐ African
- ☐ Caribbean
- ☐ Any other Black, African or Caribbean background

☐   Prefer not to say

Skip to Question 4

3e. Other Ethnic Group. Please provide further details (*Select only one option*)
- ☐ Arab
- ☐ Any other ethnic group
- ☐ Prefer not to say

Skip to Question 4

Your Coaching

4. In what part of the UK is your coaching primarily located? (*Select only one option*)
- ☐ North East
- ☐ North West
- ☐ Yorkshire and Humber
- ☐ East Midlands
- ☐ West Midlands
- ☐ East of England
- ☐ London
- ☐ South East
- ☐ South West
- ☐ Wales
- ☐ Scotland
- ☐ Northern Ireland
- ☐ Not based in the UK

5. What best describes the setting that you coach in? (*Select only one option*)
- ☐ Sports Club
- ☐ Educational Establishment (e.g., College or University)
- ☐ Private Sessions with own clients (1-2-1)
- ☐ Private sessions as part of group sessions
- ☐ Other

6. Is your coaching paid or voluntary? (*Select only one option*)
- ☐ Paid Only
- ☐ Volunteer Only
- ☐ Paid and Voluntary

7. What best describes the gender of your participants? (*Select only one option*)
- ☐ Men or Boys Only
- ☐ Women or Girls Only
- ☐ Mixed Gender

8. What is the age of your participants? (*Select only one option*)
- ☐ Pre-School (0-4)
- ☐ Young Children (5-9)
- ☐ Older Children (10-13)
- ☐ Young People (14-17)
- ☐ Adults (18-50)

☐ Older Adults (50+)

9. What best describes the background of your participants? (*Select only one option*)

☐ Participants from a low income group
☐ Participants with a physical disability
☐ Participants with a learning difficulty
☐ Participants with a long-term Illness or health conditions
☐ Participants from Black and Minority Ethnic Groups
☐ None of the above

10. What best describes the ability level of your participants? (*Select only one option*)
☐ New to the sport
☐ Recreational level
☐ Academy Level
☐ Club Level
☐ District, County or Regional Level
☐ National Level
☐ International Level
☐ Other
☐ Don't Know

11. When was the last time that you coached? (*Select only one option*)
☐ Never
☐ Longer than two years ago
☐ In the past two years
☐ In the past twelve months
☐ In the past six months

12. What do you consider as your primary roles as a Coach? (*Select all that apply*)
☐ To teach the rules of the game/sport
☐ To develop technique, teach drills and skills
☐ To prepare participants for events or competitions
☐ To promote health and personal wellbeing
☐ To build confidence and self-esteem
☐ To help people achieve their individual sports/activity goals
☐ To inspire others
☐ To get people active
☐ To keep people active
☐ To develop those who are talented
☐ Other

More about your coaching

13. Of the sports categories below, which is the one that you most closely align to as a sports coach? *(Select all that apply)*
- ☐ Athletics
- ☐ Combat Sports (e.g., Boxing, Chinese Martial Arts, Fencing, Judo, Ju Jitsu, Karate, Taekwondo, Wrestling)
- ☐ Cycling
- ☐ Equestrian Sports (e.g., Dressage, Show Jumping)
- ☐ Fielding/Striking Games (e.g., Baseball, Cricket, Rounders, Softball)
- ☐ Gymnastics and Trampolining
- ☐ Invasion Games (e.g., Basketball, Football, Hockey (Field or Ice) Lacrosse, Netball, Rugby (League or Union)
- ☐ Multi-Skills
- ☐ Net/Wall/Racquet Games (e.g., Badminton, Squash, Table Tennis, Tennis, Volleyball)
- ☐ Outdoor/Adventure Sports (e.g., Climbing, Orienteering, Parkour)
- ☐ Skating Sports (e.g., Ice Skating, Roller Skating, Skateboarding)
- ☐ Snow Sports (e.g., Bobsleigh, Skeleton, Skiing, Snowboarding)
- ☐ Target Sports (e.g., Archery, Golf, Shooting)
- ☐ Water Sports (e.g., Canoeing, Rowing, Sailing, Surfing, Water Skiing, Windsurfing)
- ☐ Weightlifting and Powerlifting

14. Of the sports categories below, which do you possess a National Governing Body coaching qualification/certificate? *(Select all that apply)*
- ☐ Athletics
- ☐ Combat Sports (e.g., Boxing, Chinese Martial Arts, Fencing, Judo, Ju Jitsu, Karate, Taekwondo, Wrestling)
- ☐ Cycling
- ☐ Equestrian Sports (e.g., Dressage, Show Jumping)
- ☐ Fielding/Striking Games (e.g., Baseball, Cricket, Rounders, Softball)
- ☐ Gymnastics and Trampolining
- ☐ Invasion Games (e.g., Basketball, Football, Hockey (Field or Ice) Lacrosse, Netball, Rugby (League or Union)
- ☐ Multi-Skills
- ☐ Net/Wall/Racquet Games (e.g., Badminton, Squash, Table Tennis, Tennis, Volleyball)
- ☐ Outdoor/Adventure Sports (e.g., Climbing, Orienteering, Parkour)
- ☐ Skating Sports (e.g., Ice Skating, Roller Skating, Skateboarding)
- ☐ Snow Sports (e.g., Bobsleigh, Skeleton, Skiing, Snowboarding)
- ☐ Target Sports (e.g., Archery, Golf, Shooting)
- ☐ Water Sports (e.g., Canoeing, Rowing, Sailing, Surfing, Water Skiing, Windsurfing)
- ☐ Weightlifting and Powerlifting

15. What is your highest level of coaching qualification (*Select only one option*)
- ☐ No qualification
- ☐ Level 1 or Activator
- ☐ Level 2
- ☐ Level 3
- ☐ Level 4
- ☐ Level 5

16. Of the sports categories below, in which do you possess your *highest National Governing Body coaching qualification/certificate? (*Select all that apply*)
- ☐ Athletics
- ☐ Combat Sports (e.g., Boxing, Chinese Martial Arts, Fencing, Judo, Ju Jitsu, Karate, Taekwondo, Wrestling)
- ☐ Cycling
- ☐ Equestrian Sports (e.g., Dressage, Show Jumping)
- ☐ Fielding/Striking Games (e.g., Baseball, Cricket, Rounders, Softball)
- ☐ Gymnastics and Trampolining
- ☐ Invasion Games (e.g., Basketball, Football, Hockey (Field or Ice) Lacrosse, Netball, Rugby (League or Union)
- ☐ Multi-Skills
- ☐ Net/Wall/Racquet Games (e.g., Badminton, Squash, Table Tennis, Tennis, Volleyball)
- ☐ Outdoor/Adventure Sports (e.g., Climbing, Orienteering, Parkour)
- ☐ Skating Sports (e.g., Ice Skating, Roller Skating, Skateboarding)
- ☐ Snow Sports (e.g., Bobsleigh, Skeleton, Skiing, Snowboarding)
- ☐ Target Sports (e.g., Archery, Golf, Shooting)
- ☐ Water Sports (e.g., Canoeing, Rowing, Sailing, Surfing, Water Skiing, Windsurfing)
- ☐ Weightlifting and Powerlifting

17. When was it that you completed your highest coaching qualification(s)? (*Select only one option*)
- ☐ Longer than five years ago
- ☐ In the past five years
- ☐ In the past two years
- ☐ Within the past 12 months
- ☐ Never
- ☐ Don't Know

18. What best describes your level of education? (*Select only one option*)
- ☐ GCSE/O-Level
- ☐ GCE/A-Level
- ☐ BTEC
- ☐ Undergraduate Degree (e.g., BA, BSc, BEng)
- ☐ Postgraduate Taught (e.g., MA, MSc)
- ☐ Postgraduate Research (e.g., MRes, MPhil)
- ☐ Doctorate (e.g., DProf, PhD, EdD)

19. Please indicate any current memberships of sporting bodies *(Select all that apply)*

☐ National Governing Body of Sport (e.g., FA, RFU, LTA etc.)
☐ International Governing Body of Sport (e.g., FIFA, World Rugby, ITF etc.)
☐ Chartered Institute for the Management of Sport and Physical Activity (CIMSPA)
☐ UK Coaching
☐ International Centre for Coaching Excellence (ICCE)
☐ None of the above
☐ Other (Please specify in the next question)

20. Please indicate below any other bodies that you are currently a member of

(Free-text response)

21. Do you consider yourself as someone involved in developing coaches? (*Select only one option)*
☐ Yes
☐ No *(Skip to Question 25)*

Type of Coach Development

22. What best describes your role as a coach developer? (*Select only one option)*

☐ I am a Coach Developer ((support coaches through a blended approach of coaching conversions, in-situ observations, critical reflection and supportive challenge etc.)
☐ I am a Mentor (I support the personal and professional development of an individual through discussion, advice and guidance)
☐ I am a Coach Educator (I work in a training, tutoring or teaching role)
☐ Quality assurance or assessment role
☐ I am a Head Coach (I line manage other coaches)
☐ Other
☐ Don't know

23. What best describes the title of your role as a Coach Developer? (*Select only one option)*

☐ Head of Coaching (*Skip to Question 25*)
☐ Head of Coaching and Qualifications (*Skip to Question 25*)
☐ Coach Development Officer (*Skip to Question 25*)
☐ Head of Coach Development (*Skip to Question 25*)
☐ Coach Development Manager (*Skip to Question 25*)
☐ Other (*Skip to Question 24*)
☐ I don't have a title for the role (*Skip to Question 25*)

24. Please provide further details below of your role as a Coach Developer

(Free-text response)

Sport Science: Knowledge and Topics

25. For each of the sport science disciplines presented below, rate their importance to your role as a coach (*Select only one option per row*)

(Options Available: Not Important Important Very Important Essential)

- ☐ Biomechanics
- ☐ Physiology
- ☐ Psychology
- ☐ Nutrition
- ☐ Strength and Conditioning
- ☐ Performance Analysis
- ☐ Skill Acquisition
- ☐ Therapeutic Modalities
- ☐ Medicine

26. For each of the topics presented below, rate their importance to your role as a coach (*Select only one option per row*)

(Options Available: Not Important Important Very Important Essential)

- ☐ Enhanced strength and power (Rate of Force Development)
- ☐ Enhanced anaerobic conditioning
- ☐ Enhanced aerobic conditioning
- ☐ Recovery Techniques
- ☐ Mental Preparation
- ☐ Goal and Target Setting
- ☐ Coping with Adversity
- ☐ Peaking for Competition
- ☐ Periodisation and Planning
- ☐ Reducing Illness
- ☐ Injury Reduction
- ☐ Improving Technique/Efficiency
- ☐ Weight Management/Control
- ☐ Nutritional Supplementation

27. At what level of coaching qualification do you feel that the following topics should form part of the qualification curriculum? (*Select only one option per row*)

(Options Available: Not Necessary/applicable Activator/ Level 1 Level 2 Level 3 Level 4 Level 5/Master Coach

- ☐ Enhanced strength and power (Rate of Force Development)
- ☐ Enhanced anaerobic conditioning
- ☐ Enhanced aerobic conditioning
- ☐ Recovery Techniques
- ☐ Mental Preparation
- ☐ Goal and Target Setting
- ☐ Coping with Adversity
- ☐ Peaking for Competition
- ☐ Periodisation and Planning
- ☐ Reducing Illness
- ☐ Injury Reduction
- ☐ Improving Technique/Efficiency
- ☐ Weight Management/Control
- ☐ Nutritional Supplementation

28. In your opinion, what other topics of sport science knowledge would benefit you most as a coach (please list all that apply, and leave blank if there are none)

(Free-text response)

Preferences for Keeping Up-to-Date

29. What methods do you currently use to keep up-to-date? (*Select all that apply*)
- ☐ Attend Workshops
- ☐ Read sport-specific magazines
- ☐ Read general sport magazines
- ☐ Attend conferences
- ☐ Read scientific journals
- ☐ Watch videos
- ☐ Networking
- ☐ World Wide Web / internet
- ☐ None of the Above
- ☐ I don't employ any methods to keep up-to-date

30. What are your preferred methods to keep up-to-date with current knowledge? *(Select all that apply)*

☐ Peer Discussion
☐ Interaction with other Coaches
☐ Applied Journals and Books
☐ Face-to-Face Workshops
☐ Conferences
☐ Networking
☐ Through a Mentor
☐ Sport-Specific Magazines
☐ Online Workshop or Webinar
☐ Distance Learning

31. In your opinion, what are the main barriers to further developing your coaching knowledge in the sport sciences?

(Free-text response)

Your Views on Coach Development, Training and Education

32. In your opinion, what should the role of a National Governing Body (NGB) be in developing coaches?

(Free-text response)

33. In your opinion, what should the role of Further (i.e., College) and Higher (i.e., University) Education be in developing coaches?

(Free-text response)

34. In your opinion, what should the role of Continued Professional Development (CPD) have in the development of coaches?

(Free-text response)

Further Details

35. The findings of this study may be further explored in future research. If you would be willing to contribute to this, please provide an e-mail address so that the lead researcher can contact you

(Free-text response)