Technology Enhanced, Interactive Remote Training and Teaching for Handball Coaches

Dr. Eoin Murray

21140642

Supervisors: Associate Professor Kirsten Spencer, Dr. Blake Bennett

A thesis submitted to Auckland University of Technology in partial fulfilment of the requirements for the degree of Master of Sport and Exercise

2022 October

School of Sport and Recreation

Abstract

Effective and accessible coach education and development is a key part of sustainable sport development. Recent world events and inequitable resource division has led to an increase in the importance and prevalence of remote learning. This study examines three methods of low-cost, simple technological enhanced learning (TEL) in handball coach education and development: Video On Demand (VOD), Interactive Video Learning (IVL) and Direct Remote Learning (DRL). Each intervention was examined under several relevant categories: accessibility, comprehensiveness, effectiveness and empowerment and compared against the others. All three methods were found to be applicable methods of remote coach learning with positive outcomes in learning and application. VOD was very accessible and thought by participants to allow learning from varied sources. Interactive methods (IVL and DRL) were preferred in most cases, however, as they promoted inter- and intra-personal relational interactions and contextual informal as well as formal learning.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ANOVA	Analysis of Variance
AUTEC	Auckland Institute of Technology Ethics Committee
CCM	Commission for Coaching and Methods
DRL	Direct Remote Learning
DSCF	Dwass-Steel-Critchlow-Fligner pairwise analysis
EHF	European Handball Federation
IHF	International Handball Federation
IVL	Interactive Video Learning
SD	Standard Deviation
TEL	Technology Enhanced Learning
VOD	Video On Demand

Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where specifically defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Student: Eoin Murray

Signature:

Date:

Declaration of Co-authorship Status

The manuscript included in this dissertation was a co-authored work between Eoin Murray (the principal author), Kirsten Spencer and Blake Bennett. In this work all preparation, research and analysis was carried out by the principal researcher (Murray) with corrections and insights from both co-authors (Bennett and Spencer).   .

Murray 90 %   ------------------------------------

Spencer 5 %   ------------------------------------

Bennett 5 %   ------------------------------------

Acknowledgements

First and foremost, huge thanks to my supervisors Kirsten Spencer and Blake Bennett for their many wise words and constant support – without them this dissertation (and my knowledge of the area) wouldn't have gotten anywhere near where it is now!

Thanks also to Handball Australia, NSW Handball and the dedicated volunteers in handball in Australia and New Zealand, especially the young coaches who are the future of the game.

Lastly, thanks to Bri for her patience and support when I needed it most.

Ethical Approval

Ethical approval for the study was granted by the Auckland Institute of Technology Ethics Committee (AUTEC) on the 10th of May 2022 (21/448).

Thesis Layout

This thesis was submitted by publication and, as such, is presented as a manuscript with additional information. The paper was submitted to the International Sport Coaching Journal (ISCJ) 21/08/2022 and resubmitted in this form updated form 04/02/23 following reviewers comments. It is presented in this thesis with minor changes for consistency, clarity and continuity.

Thus, the thesis is in the form:

- Introduction - An introduction to the project with additional background and contextual information to further introduce the sport, the current state of coach education and the theory and practicalities of coach education design and implementation.

- Manuscript – The manuscript as submitted to ISCJ for publication.

- Further Discussion – A further discussion of the results presented in the submitted paper, relating to the further themes proposed in the thesis introduction.

- Conclusion

- Supplementary information – Presentation of further quantitative data from the study to add depth and validity to the results presented in the document. These in-depth figures were not included in the published manuscript, but the general results were referred to.

Introduction

Handball

Handball is a high scoring, fast-moving invasion sport of two 30-minute halves played on a 40x20m court. Two teams of seven players (usually six outfield and one goalkeeper) try to throw a ball into the opponent's goal without outfield players entering the 6m exclusion zone around the goal. The winner is the team with the most goals scored at final whistle. The sport is characterised by fast, continuous transitions from attack to defence, full contact and quick powerful movements. At the top level there are over 100 attacks per game split roughly evenly between the teams. With minimal rest, fast changes in direction, full body contact and throwing actions resulting in ball speeds of up to 130 km/hr, it is a spectacular but physically demanding sport (Ferrari et al., 2019; Tuquet et al., 2020). There are also variations such as wheelchair handball, beach handball, field handball, street handball and mini handball with their own physical and tactical requirements. Educated, invested coaches are key to producing athletes who can compete and enjoy handball, whilst developing the sport into the future.

As an established Olympic sport, handball has been played in one form or another for centuries in Europe and is now considered one of the most popular sports in the world. The International Handball Federation (IHF) is the governing body for handball, with six regional confederations: Africa, Asia, Europe, North America and Caribbean, Oceania, and South and Central America. With over 200 national federations, 128,000 official clubs, and more than 30 million registered players, a record 2 billion supporters watched the 2021 men's world championships online and on television (see https://www.ihf.info/marketing-homepage).

Despite its popularity, handball is also a sport that is at various stages of development across the world. Most European (and a number of African, Asian and South American) countries have multiple professional leagues and comprehensive and established player and coach development programs, whereas other regions, including Oceania, struggle for resources

and knowledge. In Australia, handball is a far more recent addition to the sporting landscape. The governing body, Handball Australia, has regional associations in NSW, QLD, ACT, WA, SA and Victoria, and an estimated 1000+ players (Ausplay survey 2021). It is, however, run completely by volunteers with minimal funding and support. Thus, despite recent efforts of the IHF, coach development has lagged in Australia and the rest of Oceania in comparison to other more developed regions as a result of limitations in human and financial resources.

Handball Coach Development

With the high level of physical, mental, technical, and tactical demands in handball, modern handball coaches at every level must be flexible, dedicated but above all educated in a wide range of techniques and theories (Ferrari et al., 2019; Luteberget & Spencer, 2017; Massuca et al., 2014; Romaratezabala et al., 2018). The IHF (and in some cases, the continental or national governing bodies) provide educational opportunities for developing coaches (International Handball Federation, 2017). The IHF system has codified a hierarchical system of coach development consisting of license levels D to A (International Handball Federation, 2017). At every level the educational programs are a mix of theory, usually based in a classroom style setting, and technical learning, including practical coaching techniques and content, which is based in a sporting environment (sports hall or gym) and delivered by demonstration with athletes (International Handball Federation, 2017). In countries with developed coach development systems, license levels D to C (coaching junior players to youth and lower-level club teams) are taught by national or continental associations, and level B to A (higher level club to national team/professional) coaches are taught directly by IHF CCM lecturers, (a group of handball coach development experts). This structure of coach development is not possible in countries or regions where the appropriate coach development expertise or support is not available (including Oceania). In order to bridge this gap between

countries and regions, the IHF has made available programs that support international CCM lecturers to go to developing regions to deliver coach development at a number of levels. However, issues with the availability and accessibility of travel and associated costs have shown that this is not a sustainable model in the long-term. As a result, several international sporting associations including the IHF have made an initial foray into online educational material development (https://ihfeducation.ihf.info/). While these are excellent resources to convey the technical and tactical knowledge required to be a coach, the interactive elements of practical handball coaching are more difficult to convey online.

Coach development

The education of coaches is paramount to the development of high-quality athletes and technical advancement of sports (Stodter & Cushion, 2017). However, due to the idiosyncratic and nuanced contextual nature of coach learning, the processes by which coaches may be developed is not fully understood; or at least, is not a consensus concept (Driska & Gould, 2014; Erickson et al., 2008; Jones, 2007; Jones et al., 2012; Stodter & Cushion, 2019; Wright et al., 2007). This makes the design of universally applicable coach developmental material, or even coaching certification courses difficult. Traditional coach education and development courses often feature generic, decontextualised delivery and are sometimes seen as furthering the agendas or design of governing bodies (Webb & Leeder, 2022). There is a very recent move by sports-specific educating bodies towards a less dogmatic approach incorporating in-situ contextual shifts towards more applicable information dissemination, similar to the shift to a more widely disseminated and contextual approach to coach development instituted by the English Football Association in 2016 (Chapman et al., 2020; Dempsey et al., 2021). This social constructionist approach to educational design allows the incorporation of social and contextual

factors which can be personalised to inform the pedagogical design of educational courses (Webb & Leeder, 2022).

One of the most widely accepted core concepts of this style of course design is that knowledgeable educators who provide relevant content are essential (Mccullick et al., 2005; Papageorgiou, 2020). Additionally, there is a groundswell of research towards a belief that the formalised transfer of knowledge is limited, and informal learning experiences are more relevant and important to a coach's development (Cushion & Townsend, 2019; Stodter & Cushion, 2019; Stoszkowski & Collins, 2014, 2016). This means that coach development efforts are increasingly redirected toward the facilitation of social interactions, with additional emphasis on critical reflection. Indeed, this is considered as a more personalised, interactive, and therefore relevant approach to coach development (Chapman et al., 2020; Dempsey et al., 2021; Webb & Leeder, 2022). However, limitations of and inaccessibility to resources or personnel have made low-cost, interactive remote development methods an increasingly attractive means to develop coaches with greater flexibility and lower costs (Bennett, 2020; Zheng et al., 2020). Importantly, however, the ability of remote coach development efforts to facilitate social interaction and critical reflection is still under-researched. As such, the current study focused on providing accessible but relevant and engaging handball coach development opportunities that align with research-informed 'best practice'.

Design of Coaching Development Content and Methods

Several theoretical frameworks may be considered when designing coach development content and methods for delivery. One of the major factors to be considered is that coach development is most effective when processes for education can be directly linked to the coaches' contextual experiences. Originally proposed by Brunswik (1956) and further developed towards a more unified theory of individual/environment and perception/action

interaction by Gibson (1977), Representative Learning Design requires educational programs to be directly applicable to the participants and their environments (Araújo et al., 2007; Davids et al., 2013). The perception/action interaction is key for learning outcomes and, for maximum engagement, participants require applicable, contextual perceptual cues that are similar to the intended environment that is represented (Davids et al., 2013). Therefore, in a practical sense, coach development should mirror the tasks, environments and stimuli that are relevant to their coaching environments. Standard coach development programs can use face-to-face learning in the correct environment with live subjects to closely mirror the cues and tasks of coaching. However, remote TEL coach development that uses video-on-demand, for instance, lacks the action fidelity of these fully immersive environments and the informal cues that are required for deeper contextual understanding.

While representative learning design is key to developing educational programs that are perceptually applicable to the intended learners, similar but distinct social constructionism methods ensure that each program is contextualised to each learner and allows optimal learning conditions (Webb & Leeder, 2022). Social constructionism is a sociological theory that "rejects a dualist ontological and epistemological position, instead assuming multiple realities exist" (Webb & Leeder, 2022). The multiplicity of realities are not an objective truth that can be discovered but result from interactive collaboration and negotiation rather than a singular pre-formed interpretation of reality as in traditional coach development formats (Fairhurst & Grant, 2010). Thus, social constructionism places a high priority on communication and language to the point that these are not simply a medium of transmission but also a method by which reality can be shaped (Fairhurst & Grant, 2010; Webb & Leeder, 2022).

In an educational setting, social constructionism focusses on the mutual dependence of prior individual knowledge and social interaction in the construction of learning outcomes and knowledge dissemination (Palincsar, 1998). Therefore, coach development programmes

drawing on this theory should focus on formal and non-formal interactions within the learning group, while leaving space for critical reflection and self-directed learning (Chapman et al., 2020; Palincsar, 1998; Webb & Leeder, 2022). Arguably, simplistic information transferal methods of remote teaching (i.e. via pre-recorded videos), while excellent for self-directed learning and allowing time for critical reflection, are potentially limited in providing social interaction and socially constructed learning opportunities. Thus, there is a clear requirement for more interactive methods of remote teaching.

Technological Enhanced Learning

The proliferation and subsequent ubiquity of inexpensive communications has opened up the possibility of viable, accessible technological methods for remote education (Glassner & Back, 2010). With this, technology enhanced learning (TEL) is described as the interface between technology and education, and is emerging as a promising beneficial strategy in sport coaching education (Cushion & Townsend, 2019). However, despite this interest the core concepts of how technology can be used to enhance learning or coaching, and the subsequent effects of integration of technology into coach development (especially teaching of practical skills rather than theory) are still poorly understood (Pérez-Camarero et al., 2022; Stoszkowski et al., 2017; Stoszkowski & Collins, 2015, 2017). The use of simple video technology to teach practical elements has already been established in other fields. For instance, a mix of practical and theoretical knowledge using TEL strategies has been noted in the teaching of clinical skills to nursing students (Brooks et al., 2021; Ortega-Morán et al., 2020). Application of TEL strategies in the teaching of practical coaching skills to university sports students has also been reported on (Born et al., 2018; Papageorgiou, 2020). Nevertheless, there remains a scarcity of research examining the use of TEL strategies and where they fit in the traditional coach development theoretical landscape in coach development interventions.

Research Questions

TEL coach development needs to be underpinned by sound learning theory (Cushion & Townsend, 2019). This study seeks to explore this and will assess the response of a cohort of young handball coaches to three technological coach development interventions. Specifically, the study seeks to examine:

1. The validity of each method for handball coach development and distance coach education and development

2. The preference of the coaches for which method they would like to be applied in future handball development programs.

Methods and Methodology

Study Design

This study examined three methods of TEL strategies in practical remote coach development in handball: 1) traditional pre-recorded video-on-demand (VOD) of an educational training session, 2) an interactive online video watching session with the Coach Developer of a pre-recorded training session (Interactive Video Learning or IVL), and 3) a live/synchronous direct teaching method with the Coach Developer observing and instructing the participants via live web video (Direct Remote Learning or DRL). A semi-crossover design was implemented with half of the group participating in the IVL session before the DRL session, and vice versa for the remaining participants (Goad & Johnson, 2000). There was a break of one week between interventions (see Figure 1).

Figure 1 - Experimental design showing semi-crossover design. Total time between first and last intervention was between two and four weeks.
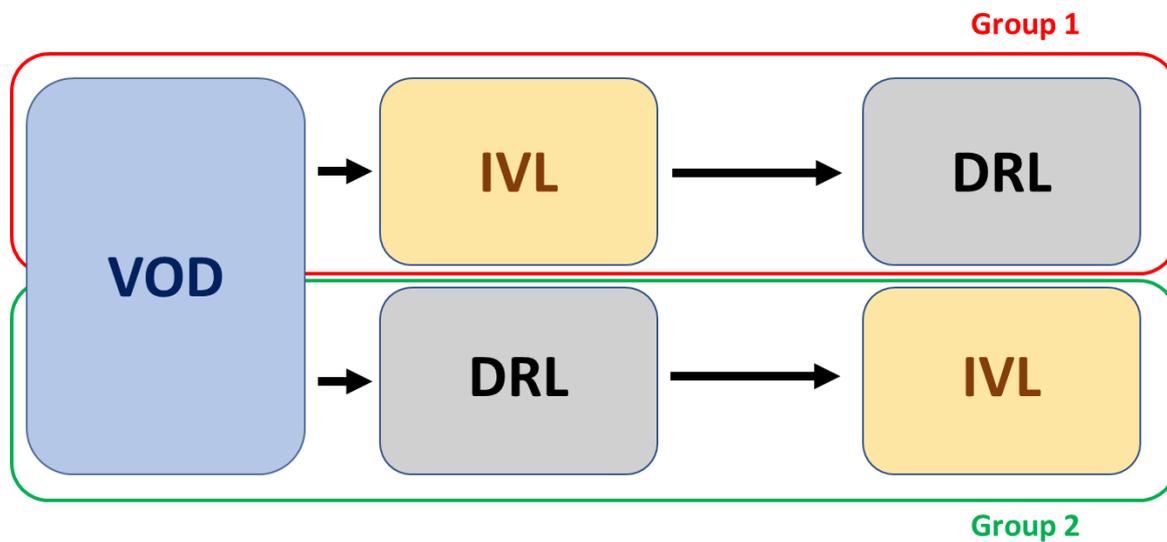
To assess the technology and content of each learning method in terms of ease of use, accessibility, quality, enjoyment, learning outcomes and applications (immediate and future), participants were sent an online Likert questionnaire (Qualtrics, Provo, Utah, USA) with formal statements relating to the categories and subcategories outlined in Table 1. The questions were adapted from studies on effective evaluation of sports education (Hammond, 2007). This allowed participants to quantitatively rate each intervention individually. The form also allowed participants to comment on their overall impressions of each intervention to provide more depth to their responses. A further section asked participants to compare the methods and comment in more detail with respect to practicality, enjoyment, advantages/disadvantages, learning outcomes and future 'wants and wishes' for learning, allowing for deeper comparative responses (Kangalgil & Özgül, 2018; Mojtahed et al., 2014). The questions were grouped into the following categories of relevant criteria developed factors deemed essential for the development of online and coach education courses (Mccullick et al., 2005; Papageorgiou, 2020): effectiveness (how effective the course was in producing the desired learning outcomes), accessibility (how accessible the method was in terms of the participants resources

and time), comprehensiveness (how comprehensive was the content and how appropriate is the method) and empowering (how empowered participants felt to apply the learnings).

Table 1 - Description of the questions asked per category in Likert questionnaire

Category	Question
Validity	
Accessible	The technology used was easy to use and understand
	The session could be undertaken with technology I already owned
	The session was an efficient use of my time
Effective	The session was clear and easy to understand
	The session was informative
	The session was interactive and immersive
	I felt my coaching knowledge improved after the session
Comprehensive	The session covered any questions I may have had
	This method of learning is an appropriate method of teaching coaching practice
	This method of learning is an appropriate method of distance education for sports
Relevant	The session encouraged me to apply these methods in my own coaching
Comparison	

		Which method did you find more enjoyable and why?
		Which method did you find more time efficient and why?
		Which method did you find easiest to use and why?
Comparison		Which method did you find the best learning method and why?
		Which method encouraged or allowed you to apply what you learned to your own coaching the most and why?
		Which method would you recommend/like to see in future coach education courses?

Participants

As a minority sport in Australia, handball is generally forced to recruit and train coaches from within its playing community. Thus, as part of a long-term development strategy, young athletes with experience playing at a higher level are developed to be the coaches of the future by taking part in educational programs and professional development. In addition, coaches who have undergone previous coach development – especially traditional educational programs – will have developed certain 'dispositions' (i.e. attitudes, preferences and biases) from these programs (Downham & Cushion, 2020; Stodter & Cushion, 2019; Webb & Leeder, 2022). These dispositions are consciously or sub-consciously shaped by previous educators, contexts or environments, and as such, recruiting young coaches with little coach education has the added advantage of minimising any possible pre-existing bias.

Participants were purposively recruited in consultation with New South Wales and Australia Handball from their prospective coaches. Participants were all under 28 years of age, with a mean age of 24 ± 3.5 years. Participants were current players with an average of 7.4 years (SD 3.5) of handball playing experience. Additionally, all were looking to or being

considered for coach development. Of the eight coaches who agreed to participate, all were representative players at State level, and seven were national team representatives at senior and/or junior level. All participants were living/coaching/playing in New South Wales, Australia, and were either Australian (87.5 %) or New Zealand (12.5 %) citizens. Coaching experience varied from 0-3 years at school or junior level, with little or no experience of handball education processes.

Coach Developer

The Coach Developer of this study, also the first author, is a leading handball coaching instructor in Oceania and a Commission of Coaching Methods lecturer with the International Handball Federation. As the Coach Developer was also an Australian coach lecturer the participants responses were anonymised and the project did not form any part of a coach education program so as not to (dis)advantage in any future coaching education. The role of the Coach Developer in this study was three-fold:

1) VOD: the Coach Developer's only role was to select the video and approve the content for the context of the study and level of the Participants. The video selected dealt with a methodical training approach to introducing offensive-defensive transition skills and techniques.

2) IVL: the Coach Developer selected and approved the video under consideration as before. In this case, the Coach Developer was able to interact with the Participants while co-watching the content over video conferencing software (Google Meet). This allowed the Coach Developer to encourage further discussion and reflection on the content and answered any questions the participants may have had. The video selected dealt with a methodical training approach to introducing line player skills and techniques. Participants were asked to reflect throughout the video on the effectiveness of this session content, how they would approach this

topic and the methods of the coach and application of this in their own coaching. Interaction was strongly encouraged.

3) DRL: the Coach Developer observed the Participant delivering a training session over a video conferencing platform while being able to give feedback visually via whiteboard and video and aurally via a Bluetooth earpiece. In the first half of the session the Participant delivered a short session of their own design and the Coach Developer advised on improvements and encouraged self-reflective practices. Participants were able to explain their thinking processes and ask any questions they may have had. In the second half, the Participant was instructed directly to deliver a session of the Coach Developer's design carrying on the same topic from the first half. Again, participants were encouraged to interact and suggest changes and opinions.

Practical considerations

Videos for VOD and IVL were sourced from European handball coaching educational resource (EHF Activities www.youtube.com/c/EHFActivities/videos). These are freely available online and were deemed to be an appropriate level for the participants. The VOD could be viewed on any compatible device at any time, but were viewed by all participants before the other interventions took place. Both the IVL and DRL teaching methods used Google Meet video communication app as it was easily available across most platforms and allowed screen sharing and virtual whiteboard functions. Google Meet was also a commonly used platform among participants. Interactive co-viewing of video footage could be performed on any compatible device with WIFI or cellular connection and was easily expanded into group sessions to allow more in-depth discussion.

DRL required a WIFI or cellular connection for both Participant and Coach Developer. Participants streamed their training session privately to the Coach Developer using their own

smart phone, either holding the phone or using a simple tripod mount. Questions, answers and instructions were facilitated via Bluetooth earphone. This allowed the Coach Developer to observe from the participants perspective (when the phone was held) or have a wider view if the participant had access to a tripod mount. These methods could be easily combined so the Coach Developer could have close and wider views of the training session. Using a single Bluetooth earpiece allowed easy communication between Coach Developer and Participant without compromising the Participants' interaction with the athletes when coaching. Also the Whiteboard function on Google Meet allowed the Coach Developer to more clearly explain concepts as they are happening.

Data Analysis

Data from the Likert responses were analysed by organising data sets and calculating mean percentages from survey data to examine the validity of each intervention in turn. Responses to open questions were used to add depth and context. Violin plots were also generated to assess the distribution of responses across each category.

Subsequent analysis was carried out using Jamovi software (The Jamovi project, Version 1.6 2021). For quantitative analysis, Likert responses were given numerical values (Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2 and Strongly Disagree = 1) (Mircioiu & Atkinson, 2017). An independent Mann-Whitney U-test was carried out for every question to check for significant differences between group 1 and group 2 due to intervention order (IVL then DRL or DRL then IVL). VOD was not considered for analysis as Participants could participate in VOD at any time and, in this study, all Participants participated in the intervention before the other two. Non-parametric Kruskal-Wallis ANOVA and subsequent Dwass-Steel-Critchlow-Fligner (DSCF) pairwise analyses were performed on every question individually and every category as a whole.

The analysis of the data collected in this study was applied to assess the individual validity of all three methods of TEL practical remote coach education in handball and, along with the opinions of participants to lend contextual depth, the relative and comparative merits of each. This was presented in a paper submitted to the International Sport Coaching Journal presented below.

Manuscript

(Submitted to International Sport Coaching Journal 21/08/2022 and resubmitted in this form updated form 04/02/23 following reviewers comments. Note, references from submitted article have been incorporated into this dissertation for ease of reading, formatting is as submitted including figure numbers. In addition, the submitted manuscript used the term 'Instructor' to refer to Coach Developer. 'Instructor' has now been replaced with 'Coach Developer' throughout to more accurately reflect terminology used globally in this field. This change will also be made in the published version of the manuscript).

REDACTED

Further Discussion

The aim of this study was to assess the validity of three methods of cost-effective TEL strategies for remote coaching education in handball; and the relative merits of each when applied to the education of young athletes early in their transition to coaching. To this end, coach development sessions using video-on-demand (VOD), Interactive Video Learning (IVL) and Direct Remote Learning (DRL) methodologies were carried out with a small cohort of young elite athletes beginning their coaching journey and their perception of each intervention were assessed and compared.

Validity of methods

Initial and continuous coach learning and education is key to providing new and on-going coaches with a pedagogical knowledge and behavioural base to improve their coaching and better serve their athletes (Burden & Lambie, 2016; Moen, Haugan, et al., 2021; Moen, Olsen, et al., 2021; Stonebridge & Cushion, 2018; Webb & Leeder, 2022). These educational methods and the content therein must be validated initially then constantly challenged to remain valid and applicable for use. When introducing an educational method or intervention it must be measured for validity and quality against previous or current methods of teaching. In this case, the ongoing validity of more established VOD-style learning methods was assessed alongside two interactive methods. Participants' opinions and perceptions of the key features of each technology that impacted learner interaction and outcomes were assessed and compared and showed that all were acceptable methods of remote handball education.

While the value of participants perception in program and method development has been debated, McCullick (2005) showed that the opinion of participants is key to the development of holistic learning experiences and sustainable method development. This is particularly true when considering that those undergoing education currently will be those with influence of any coming generation of athletes and coaches and are likely to be involved in

designing educational resources in the future (Callary et al., 2011; Mccullick et al., 2005). The tendency of coaches to form biases and specific dispositions influenced by the educators of coaches, particularly those teaching and influencing novice coaches can lead to perpetuating non-optimal coach development systems. (Stodter & Cushion, 2017, 2019; Webb & Leeder, 2022). Thus, the importance of valid, representative learning design methodologies and the participants' reaction to these to sustainable coach development programs cannot be understated and the use, in this study, of a relatively homogeneous group of coaches with little or no prior influence of previous coach development may have contributed to receiving relevant and unbiased feedback from the participants.

Implementation of TEL

With the increasing ease of access to information, the challenge in the design of coaching programs is becoming less *what* to teach but rather *how* to teach it (Callary et al., 2011; Pérez-Camarero et al., 2022). This study seeks to compile, adapt and present the extant knowledge of handball coaching into an accessible, relevant and appealing form for the intended audience. Reade (2008) has shown that coaches are far more likely to interact informally with other coaches or in a formalised organised learning setting when seeking knowledge, rather than self-seek through online resources or direct requests to educators or researchers. These informal or formal educational processes are not always possible in environments where access to the educational processes are unavailable, or distances are great and coaches struggle to interact with each other. This is very prevalent in the population examined in this study, Australian handball, where there are no professional coaches, coach development opportunities are limited and formal or informal face-to-face interaction is not regularly possibly.

Effective coaching is based not just on theoretical knowledge but on a range of interpersonal and intrapersonal knowledge and skills (Côté & Gilbert, 2009). A certain level of theoretical knowledge on the technical and tactical methods can be expected with elite athletes transition to coaching (Chroni et al., 2020; Chroni & Dieffenbach, 2022). However, the nuances of coaching, the contextual and personal elements, are not innately known and can only be learned through education and on-going professional development support (Chroni et al., 2020; Chroni & Dieffenbach, 2022) and through informal interactions with educators, other coaches and athletes (Stodter & Cushion, 2019; Stoszkowski & Collins, 2016). This is especially true of young coaches (Marinho et al., 2020). Any coach development method that does not feature or allow these contextual learnings will perhaps produce coaches that lack the competences required to able perform the core duties of a coach across a wide range of situations and contexts. Therefore any representative learning designed coach development programs must take into account these informal or interpersonal learning methodologies (Brunswik, 1956; Gibson, 1977). In this sense, while the more traditional pre-recorded VOD teaching method featured in this study, is easy to use and an excellent opportunity to learn from multiple expert sources, these simple VOD strategies lack the social constructionistic contextual, perceptual and inter- and intrapersonal elements that promote interactive, formal and informal learning (Cushion & Townsend, 2019). In the VOD interventions featured in this study, the educator in the video was performing familiar tasks in environments that were recognisable for the participants (handball training on handball courts). However, this coaching education technique lack the open communication pathways and the true action fidelity and feedback of an immersive environment that would elicit the appropriate perception/action response from the participants (Davids et al., 2013). This is clearly seen in the participants response to the VOD intervention in this study, as the least preferred method of coach education.

Interactive methods, such as the IVL and DRL interventions used in this study allow for contextual learning and are adaptable according to the requirements of Coach Developer or Participant. Although IVL lacks the immersive qualities of a true in-person coaching experience, it allows for further discussion in a formal manner with the Coach Developer and informally with peers. DRL goes further by allowing communication in every sense with the Coach Developer and the athletes involved. Additional communication and interaction with their peers could be included by adding observers to the lesson. More than this, DRL allows participants to directly implement learnings - interacting with other coaches and learning by doing, the preferred method of coach learning (Maclean & Lorimer, 2016). As flexible, interactive methodologies, IVL and DRL focus on formal and non-formal mutual interactions with Coach Developer and others and allow scope for individualised, mutually beneficial educational pathways, and the critical reflection vital for successful socially constructed learning (Chapman et al., 2020; Palincsar, 1998; Webb & Leeder, 2022)

Previous research on handball coaches undergoing structured education and professional development has shown the importance of coach-centred approaches to education (Moen, Olsen, et al., 2021). The use of lessons focussed on interaction, that are possible in the IVL and DRL approaches examined in this paper, provides opportunities for coaches to develop critical listening and questioning skills that can be applied to their athletes and improve coach-athlete relations which are key to both athlete and coach development (Gessnitzer & Kauffeld, 2015). DRL-style approaches even allow instantaneous application of these inter-personal skills with immediate response and reaction from an instructor, coach and athlete in a positive feedback cycle. The result is that the Coach Developer's perspectives can be more fully understood when seen in context; athletes' responses can be assessed and responded to immediately by both Participant and Coach Developer and coaching relationships with both can be developed based on mutuality and trust (Moen et al., 2021).These relational advantages

may overcome the negative reactions to previous online teaching techniques (Kim et al., 2021) and provide handball and other sports a valid choice of educational approaches to remote coach development

Conclusion

In this study three TEL strategies for remote coach development in handball were examined. Using a cohort of aspiring coaches with extensive playing experience and sport knowledge, but very little experience of practical coaching or formal coach development processes, the validity of VOD, IVL and DRL methods to the coach learning experiences of these coaches were tested. All three intervention methods were shown to be suitable methods for the delivery of coach development in the sport of handball, however the interactive methods (IVL and DRL) were generally preferred in all categories. VOD methods were convenient and allowed access to a multitude of instructor or setting possibilities but lacked the contextual interpersonal relational elements that allowed informal learning. DRL methods, on the other hand, provided immediate application, reaction and response of learnings while allowing communication to occur directly with both Coach Developer and athletes. This also had the benefit of allowing advanced contextual learning and opportunities for relational improvement. On the basis of these findings, it is possible to suggest that all three methods allow accessible remote coach development using low-cost, almost universally familiar technology, and can therefore be used as part of an ongoing coach development program in the sport of handball.

Supplementary Information

This section contains supplementary results which were not submitted in the article but are still relevant to a deeper understanding of the results. Table SI-1 shows no significant

correlation in an independent Mann-Whitney U-test and subsequent normality Shapiro-Wilks

test resulting from the order in which the interventions were carried out as stated in the paper

Table SI-1.

Mann-Whitney U-test and Shapiro-Wilk test for normality for all questions for all interventions showing any correlation/significant differences between intervention order (group 1 IVL-DRL and group 2 DRL-IVL)

		Mann-Whitney U	Normality Test (Shapiro-Wilk)
		p	*p*
	Tech easy to Understand	0.608	0.076
	Already owned tech	1.000	n/a
	Session was clear and easy to understand	1.000	n/a
	The session was informative	1.000	0.002
	The session was an efficient use of my time	0.491	0.001
VOD	The session was interactive and immersive	0.870	0.020
	The session covered any questions I may have had	0.324	0.046
	Coaching knowledge improved after the session	0.744	0.085
	Appropriate method of teaching coaching practice	0.752	0.228
	Appropriate method of distance education for sports	0.608	0.076
	Encouraged me to apply in own coaching	0.752	0.046
	Tech easy to Understand	1.000	0.002
	Already owned tech	1.000	n/a
	Session was clear and easy to understand	0.606	< .001
	The session was informative	0.606	< .001
	The session was an efficient use of my time	0.844	0.002
IVL	The session was interactive and immersive	0.302	0.010
	The session covered any questions I may have had	1.000	n/a
	Coaching knowledge improved after the session	0.324	0.046
	Appropriate method of teaching coaching practice	0.844	0.002
	Appropriate method of distance education for sports	0.844	0.002
	Encouraged me to apply in own coaching	0.844	0.002
	Tech easy to Understand	0.514	0.535
	Already owned tech	0.168	0.093
	Session was clear and easy to understand	1.000	0.052
	The session was informative	0.696	0.035
	The session was an efficient use of my time	0.290	0.295
DRL	The session was interactive and immersive	1.000	0.002
	The session covered any questions I may have had	0.696	0.035
	Coaching knowledge improved after the session	1.000	0.052

32

Appropriate method of teaching coaching practice	0.228	0.153
Appropriate method of distance education for sports	0.844	0.002
Encouraged me to apply in own coaching	0.863	0.052

Table SI-2 shows no significant correlation in a non-parametric ANOVA Kruskal-Wallis test between interventions in each question. Subsequent Dwass-Steel-Critchlow-Fligner (DSCF) pairwise analysis for each question showed no further significant correlation or differences.

Table SI-2.

Non-parametric ANOVA Kruskal-Wallis test between VDO-IVL-DRL interventions for each question with correlation (p) and effect size (ε^2)

	χ^2	df	p	ε^2
Tech easy to understand	0.489	2	0.783	0.0212
Already owned tech	6.545	2	0.038	0.2846
Session was clear and easy to understand	1.645	2	0.439	0.0715
The session was informative	1.186	2	0.553	0.0516
The session was an efficient use of my time	0.476	2	0.788	0.0207
The session was interactive and immersive	2.759	2	0.252	0.12
The session covered any questions	2.298	2	0.317	0.0999
Coaching knowledge improved	1.898	2	0.387	0.0825
Appropriate for teaching coaching practice	2.833	2	0.243	0.1232
Appropriate for distance education for sports	0.9	2	0.638	0.0391
Encouraged me to apply in own coaching	2.833	2	0.243	0.1232

Table SI-3 shows a significant difference in only in the Effective category in non-parametric ANOVA Kruskal-Wallis tests between VDO-IVL-DRL interventions in each category. Further analysis using subsequent DSCF pairwise analysis showed significant difference between VOD and IVL interventions.

Table SI-3.

Non-parametric ANOVA Kruskal-Wallis test between VDO-IVL-DRL interventions in each category with correlation (p) and effect size (ε^2). Also, subsequent DSCF pairwise comparison for the Effective category

	χ^2	df	p	ε^2
Accessible	3.01	2	0.222	0.042
Effective	6.76	2	**0.034**	0.071
Comprehensive	4.68	2	0.096	0.066
Empowering	2.83	2	0.243	0.123

Effective		W	p
VOD	IVL	3.66	**0.026**
VOD	DRL	1.11	0.714
IVL	DRL	-2.6	0.156

Figure SI-1 shows the validity for each intervention when ordered by category. Validity is measured by an average of all responses in that category and intervention. Errors are estimated from standard deviation from the mean.

Figure S1-1
Validity of each intervention for each category. Validity is estimated from the average responses to every question in each category and error estimated from the average standard deviation from the mean.
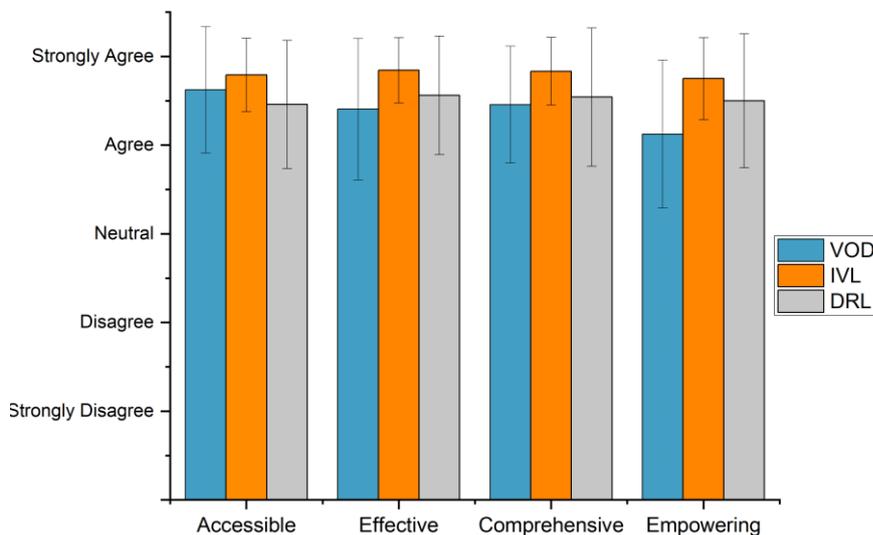

Figure SI-2 shows the validity of each intervention across all categories when grouped by intervention. Validity is again estimated from average responses in each category and an

overall validity from the average of all responses across all categories. Deviation from the mean

is also displayed. This result shows that all interventions can be said to be valid methods of

remote teaching of handball coach education in all categories and overall.

Figure SI-2

Validity of each intervention where validity is an average of each category and an overall
average of all categories
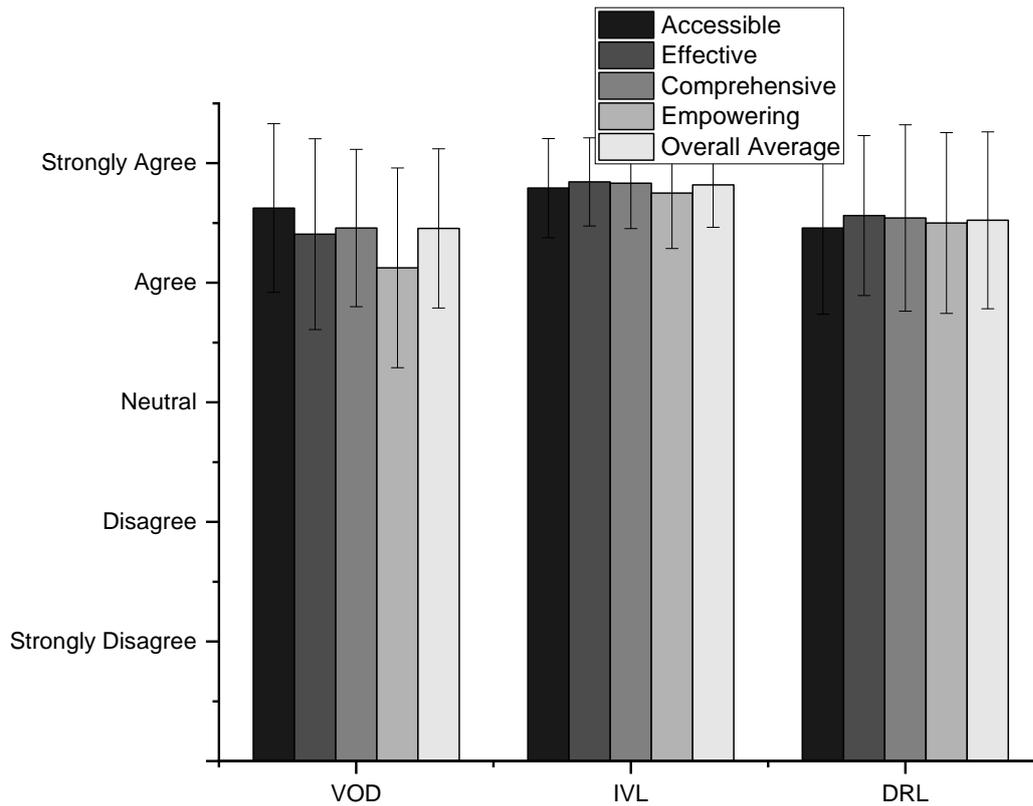
References

Araújo, D., Davids, K., & Passos, P. (2007). Ecological validity, representative design, and correspondence between experimental task constraints and behavioral setting: Comment on Rogers, Kadar, and Costall (2005). In *Ecological Psychology* (Vol. 19, Issue 1, pp. 69–78). Lawrence Erlbaum Associates Inc. https://doi.org/10.1080/10407410709336951

Bennett, B. (2020). The Video Coach—reflections on the use of ICT in high-performance sport. *International Sport Coaching Journal*, *7*(2), 220–228. https://doi.org/10.1123/iscj.2019-0048

Bennett, B. C. (2021). My video coach - a phenomenographic interpretation of athlete perceptions of coaching through a live video feed. *Qualitative Research in Sport, Exercise and Health*, *13*(3), 455–472. https://doi.org/10.1080/2159676X.2020.1733643

Born, P., Nguyen, N. P., Grambow, R., Meffert, D., & Vogt, T. (2018). Embedding tennis-specific teaching videos into long-term educational concepts to improve movement learning and technique performances. *Journal of Physical Education and Sport*, *18*(1), 255–261. https://doi.org/10.7752/jpes.2018.01034

Brooks, A. J., Maizes, V., Billimek, J., Blair, J., Chen, M. K., Goldblatt, E., Kilgore, D., Klatt, M., Kligler, B., Koithan, M. S., Kreitzer, M. J., Lee, J. K., Lopez, A. M., Taren, D., & Lebensohn, P. (2021). Professional development in integrative health through an interprofessional online course in clinical settings. *Explore*, *17*(6), 505–512. https://doi.org/10.1016/j.explore.2020.02.014

Brunswik, E. (1956). *Perception and the Representative design of psychological experiments*. University of California Press.

Burden, J. W., & Lambie, G. W. (2016). Sociocultural competencies for sport coaches: A proposal for coaches and coach education. *Journal of Coaching Education*, *4*(3), 3–28. https://doi.org/10.1123/jce.4.3.3

Busser, J. A., & Carruthers, C. P. (2010). Youth sport volunteer coach motivation. *Managing Leisure*, *15*(1–2), 128–139. https://doi.org/10.1080/13606710903448210

Callary, B., Werthner, P., & Trudel, P. (2011). A brief online survey to help a sport organization continue to develop its coach education program. In *International Journal of Coaching Science* (Vol. 5, Issue 2).

Chapman, R., Richardson, D., Cope, E., & Cronin, C. (2020). Learning from the past; a Freirean analysis of FA coach education since 1967. *Sport, Education and Society*, *25*(6), 681–697. https://doi.org/10.1080/13573322.2019.1654989

Chroni, S. "Ani," & Dieffenbach, K. (2022). Facilitating and supporting the elite athlete-to-coach transition: lessons learned from Norwegian coaches and federations. *Journal of Sport Psychology in Action*, *13*(1), 27–39. https://doi.org/10.1080/21520704.2020.1861145

Chroni, S. "Ani," Pettersen, S., & Dieffenbach, K. (2020). Going from athlete-to-coach in Norwegian winter sports: understanding the transition journey. *Sport in Society*, *23*(4), 751–773. https://doi.org/10.1080/17430437.2019.1631572

Clarke, V., Braun, V., & Hayfield, N. (2015). Thematic analysis. In J. A. Smith (Ed.), *Qualtitative Psychology: A practical guide to research methods.*

Côté, J., & Gilbert, W. (2009). An integrative definition of coaching effectiveness and expertise. *International Journal of Sports Science and Coaching*, *4*(3), 307–323.

Cushion, C. J., & Townsend, R. C. (2019). Technology-enhanced learning in coaching: a review of literature. *Educational Review*, *71*(5), 631–649. https://doi.org/10.1080/00131911.2018.1457010

Datta, L. E. (1997). A pragmatic basis for mixed-method designs. *New Directions for Evaluation*, *1997*(74), 33–46. https://doi.org/10.1002/ev.1070

Davids, K., Araújo, D., Vilar, L., Renshaw, I., & Pinder, R. (2013). An ecological dynamics approach to skill acquisition: implications for development of talent in sport theoretical

principles of ecological dynamics. In *An Ecological Dynamics Approach to Skill Acquisition 21 Talent Development & Excellence* (Vol. 5, Issue 1). http://www.iratde.org

Dempsey, N. M., Richardson, D. J., Cope, E., & Cronin, C. J. (2021). Creating and disseminating coach education policy: a case of formal coach education in grassroots football. *Sport, Education and Society*, *26*(8), 917–930. https://doi.org/10.1080/13573322.2020.1802711

Downham, L., & Cushion, C. (2020). Reflection in a high-performance sport coach education program: a Foucauldian analysis of coach developers. *International Sport Coaching Journal*, *7*(3), 347–359. https://doi.org/10.1123/iscj.2018-0093

Driska, A. P., & Gould, D. R. (2014). Evaluating a problem-based group learning strategy for online, graduate-level coach education. *Kinesiology Review*, *3*(4), 227–234. https://doi.org/10.1123/kr.2014-0061

Erickson, K., Bruner, M. W., Macdonald, D. J., & Côté, J. (2008). Gaining insight into actual and preferred sources of coaching knowledge. In *International Journal of Sports Science & Coaching* (Vol. 3, Issue 4). www.icce.ws

Evans, B. C., Coon, D. W., & Ume, E. (2011). Use of theoretical frameworks as a pragmatic guide for mixed methods studies: A methodological necessity? *Journal of Mixed Methods Research*, *5*(4), 276–292. https://doi.org/10.1177/1558689811412972

Eynon, R., & Malmberg, L. E. (2021). Lifelong learning and the Internet: Who benefits most from learning online? *British Journal of Educational Technology*, *52*(2), 569–583. https://doi.org/10.1111/bjet.13041

Fairhurst, G. T., & Grant, D. (2010). The social construction of leadership: A sailing guide. *Management Communication Quarterly*, *24*(2), 171–210. https://doi.org/10.1177/0893318909359697

Ferrari, W., Sarmento, H., & Vaz, V. (2019). Match analysis in handball: A systematic review. *Montenegrin Journal of Sports Science and Medicine*, *8*(2), 63–76. https://doi.org/10.26773/mjssm.190909

Feilzer, M. Y. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, *4*(1), 6–16. https://doi.org/10.1177/1558689809349691

Fukunaga, M. M., & Kasamatsu, T. M. (2022). Purposeful course planning: considering student self-efficacies when selecting an online, hybrid, face-to-face course delivery modality. *Athletic Training Education Journal*, *17*(3), 201–209. https://doi.org/10.4085/1947-380x-21-038

Gessnitzer, S., & Kauffeld, S. (2015). The working alliance in coaching: Why behavior is the key to success. *Journal of Applied Behavioral Science*, *51*(2), 177–197. https://doi.org/10.1177/0021886315576407

Gibson, J. J. (1977). *The ecological approach to visual perception* (Classic Edition). Psychology Press.

Glazier, R. A., Hamann, K., Pollock, P. H., & Wilson, B. M. (2020). Age, gender, and student success: mixing face-to-face and online courses in political science. *Journal of Political Science Education*, *16*(2), 142–157. https://doi.org/10.1080/15512169.2018.1515636

Glassner, A., & Back, S. (2010). *Exploring Heutagogy in Higher Education Academia Meets the Zeitgeist*. Springer Nature Pte Ltd.

Goad, C. L., & Johnson, D. E. (2000). Crossover experiments: A comparison of ANOVA tests and alternative analyses. In *Source: Journal of Agricultural, Biological, and Environmental Statistics* (Vol. 5, Issue 1). https://www.jstor.org/stable/1400632

Griffiths, M. A., Goodyear, V. A., & Armour, K. M. (2022). Massive open online courses (MOOCs) for professional development: meeting the needs and expectations of physical education

teachers and youth sport coaches. *Physical Education and Sport Pedagogy*, *27*(3), 276–290. https://doi.org/10.1080/17408989.2021.1874901

International Handball Federation. (2017). *International Handball Federation XXVII. IHF Coaching Education Regulations*. http://ihfeducation.ihf.info/

Jones, R. (2007). Coaching redefined: An everyday pedagogical endeavour. *Sport, Education and Society*, *12*(2), 159–173. https://doi.org/10.1080/13573320701287486

Jones, R., Morgan, K., & Harris, K. (2012). Developing coaching pedagogy: Seeking a better integration of theory and practice. *Sport, Education and Society*, *17*(3), 313–329. https://doi.org/10.1080/13573322.2011.608936

Kangalgil, M., & Özgül, F. (2018). Use of feedback in physical education and sports lessons for student point of view. *Universal Journal of Educational Research*, *6*(6), 1235–1242. https://doi.org/10.13189/ujer.2018.060614

Kim, M., Yu, H., Park, C. W., Ha, T., & Baek, J. H. (2021). Physical education teachers' online teaching experiences and perceptions during the covid-19 pandemic. *Journal of Physical Education and Sport*, *21*, 2049–2056. https://doi.org/10.7752/jpes.2021.s3261

Lockee, B. B. (2021). Online education in the post-COVID era. In *Nature Electronics* (Vol. 4, Issue 1, pp. 5–6). Nature Research. https://doi.org/10.1038/s41928-020-00534-0

Luteberget, L. S., & Spencer, M. (2017). High-intensity events in international women's team handball matches. *International Journal of Sports Physiology and Performance*, *12*, 56–61.

Maclean, J., & Lorimer, R. (2016). Are coach education programmes the most effective method for coach development? In *International Journal of Coaching Science* (Vol. 10, Issue 2).

Marinho, D. A., Barbosa, T. M., Lopes, V. P., Forte, P., Toubekis, A. G., & Morais, J. E. (2020). The influence of the coaches' demographics on young swimmers' performance and technical determinants. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.01968

Massuca, L., Fragoso, I., & Teles, J. (2014). Attribute of top elite team-handball players. *Journal of Strength and Conditioning Research*, *28*(1), 178–186.

Mccullick, B. A., Belcher, D., & Schempp, P. G. (2005). What works in coaching and sport instructor certification programs? The participants' view. *Physical Education in Sport Pedagogy*, *10*(2), 121–137.

Mircioiu, C., & Atkinson, J. (2017). A comparison of parametric and non-parametric methods applied to a Likert scale. *Pharmacy*, *5*(4), 26. https://doi.org/10.3390/pharmacy5020026

Moen, F., Haugan, J. A., Olsen, M., & Bjørkøy, J. A. (2021). Effects of a one-year coaching educational program on athlete perception of the coach–athlete working alliance. *Journal of Physical Education and Sport*, *21*(3), 1395–1405. https://doi.org/10.7752/jpes.2021.03178

Moen, F., Olsen, M., & Bjørkøy, J. A. (2021). Investigating possible effects from a one-year coach-education program. *Sports*, *9*(1), 1–13. https://doi.org/10.3390/sports9010003

Mojtahed, R., Nunes, M. B., Martins, J. T., & Peng, A. (2014). Equipping the constructivist researcher: the combined use of semi-structured interviews and decision-making maps. *Electronic Journal of Business Research Methods*, *12*(2), 87–95. www.ejbrm.com

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative Inquiry*, *20*(8), 1045–1053. https://doi.org/10.1177/1077800413513733

Morin, D., Safaee Fard, H., & George Saadé, R. (2019). Understanding online learning Based on different age categories. *Issues in Informing Science and Information Technology*, *16*, 307–317. https://doi.org/10.28945/4313

Ortega-Morán, J. F., Pagador, B., Maestre-Antequera, J., Arco, A., Monteiro, F., & Sánchez-Margallo, F. M. (2020). Validation of the online theoretical module of a minimally invasive surgery blended learning course for nurses: A quantitative research study. *Nurse Education Today*, *89*. https://doi.org/10.1016/j.nedt.2020.104406

Palincsar, A. S. (1998). Social constructivist perspectives on teaching and learning. In *Annu. Rev. Psychol* (Vol. 49).

Papageorgiou, K. G. (2020). Online coach development and certification programs in sports: Are they possible? In *Central European Journal of Sport Sciences and Medicine* (Vol. 32, pp. 69–75). Wydawnictwo Naukowe Uniwersytetu Szczecinskiego. https://doi.org/10.18276/CEJ.2020.4-07

Pérez-Camarero, J., Martínez-Gallego, R., Guzmán, J. F., & Crespo, M. (2022). Online training of sports coaches: bibliographic review. *Apunts. Educacion Fisica y Deportes*, *147*, 26–35. https://doi.org/10.5672/apunts.2014-0983.es.(2022/1).147.03

Petrušič, T., & Štemberger, V. (2021). Effective physical education distance learning models during the covid-19 epidemic. *Center for Educational Policy Studies Journal*, *11*(Special Issue), 291–308. https://doi.org/10.26529/cepsj.1118

Piggott, D. (2012). Coaches' experiences of formal coach education: a critical sociological investigation. *Sport, Education and Society*, *17*(4), 535–554. https://doi.org/10.1080/13573322.2011.608949

Preston, C., Allan, V., & Fraser-Thomas, J. (2021). Facilitating positive youth development in elite youth hockey: exploring coaches' capabilities, opportunities, and motivations. *Journal of Applied Sport Psychology*, *33*(3), 302–320. https://doi.org/10.1080/10413200.2019.1648327

Reade, I., Rodgers, W., & Hall, N. (2008). Knowledge transfer: how do high performance coaches access the knowledge of sport scientists? *International Journal of Sports Science & Coaching*, *3*(3), 319–328.

Romaratezabala, E., Nakamura, F., Ramirez-Campillo, Rodrigo Rodrigo-Negro, J., & Yanci, J. (2018). Differences in physical performance according to the competitive level in amateur handball players. *Journal of Strength and Conditioning Research*, *34*(7), 2048–2054.

Ronkainen, N. J., & Wiltshire, G. (2021). Rethinking validity in qualitative sport and exercise psychology research: a realist perspective. *International Journal of Sport and Exercise Psychology*, *19*(1), 13–28. https://doi.org/10.1080/1612197X.2019.1637363

Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology*, *11*(1), 101–121. https://doi.org/10.1080/1750984X.2017.1317357

Stodter, A., & Cushion, C. J. (2017). What works in coach learning, how, and for whom? A grounded process of soccer coaches' professional learning. *Qualitative Research in Sport, Exercise and Health*, *9*(3), 321–338. https://doi.org/10.1080/2159676X.2017.1283358

Stodter, A., & Cushion, C. J. (2019). Evidencing the impact of coaches' learning: Changes in coaching knowledge and practice over time. *Journal of Sports Sciences*, *37*(18), 2086–2093. https://doi.org/10.1080/02640414.2019.1621045

Stonebridge, I., & Cushion, C. (2018). An exploration of the relationship between educational background and the coaching behaviours and practice activities of professional youth soccer coaches. *Physical Education and Sport Pedagogy*, *23*(6), 636–656. https://doi.org/10.1080/17408989.2018.1485143

Stoszkowski, J., & Collins, D. (2014). Communities of practice, social learning and networks: Exploiting the social side of coach development. *Sport, Education and Society*, *19*(6), 773–788. https://doi.org/10.1080/13573322.2012.692671

Stoszkowski, J., & Collins, D. (2015). Sources, topics and use of knowledge by coaches. *Journal of Sport Science*, *34*(9), 794–802.

Stoszkowski, J., & Collins, D. (2017). Using shared online blogs to structure and support informal coach learning—part 1: a tool to promote reflection and communities of practice. *Sport, Education and Society*, *22*(2), 247–270. https://doi.org/10.1080/13573322.2015.1019447

Stoszkowski, J., Collins, D., & Olsson, C. (2017). Using shared online blogs to structure and support informal coach learning. Part 2: the participants' view and implications for coach education. *Sport, Education and Society*, *22*(3), 407–425. https://doi.org/10.1080/13573322.2015.1030382

Szedlak, C., Smith, M. J., & Callary, B. (2022). "Nothing was lost sailing-wise and lots is gained on a personal level": Practitioners' behaviors and athletes' perceptions of working in online environments. *Psychology of Sport and Exercise*, *63*. https://doi.org/10.1016/j.psychsport.2022.102285

Tuquet, J., Zapardiel, J. C., Saavedra, J. M., Ja, D., & Lozano, D. (2020). Relationship between Anthropometric Parameters and Throwing Speed in Amateur Male Handball Players at Di ff erent Ages. *International Journal of Environmental Research and Public Health*, *17*, 7022.

Varea, V., & González-Calvo, G. (2020). Touchless classes and absent bodies: teaching physical education in times of Covid-19. *Sport, Education and Society*, 1–15. https://doi.org/10.1080/13573322.2020.1791814

Webb, K., & Leeder, T. M. (2022). Dispositions and coaching theories: understanding the impact of coach education on novice coaches' learning. *Sport, Education and Society*, *27*(5), 618–631. https://doi.org/10.1080/13573322.2021.1887846

Wright, T., Trudel, P., & Culver, D. (2007). Learning how to coach: the different learning situations reported by youth ice hockey coaches. *Physical Education & Sport Pedagogy*, *12*(2), 127–144. https://doi.org/10.1080/17408980701282019

Zheng, B., Lin, C. H., & Kwon, J. B. (2020). The impact of learner-, instructor-, and course-level factors on online learning. *Computers and Education*, *150*. https://doi.org/10.1016/j.compedu.2020.103851

Appendices

Appendix A – Ethics Consent

Auckland of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

10 May 2022

Kirsten Spencer
Faculty of Health and Environmental Sciences

Dear Kirsten

Re Ethics Application: **21/448 Technology enhanced, interactive remote training and teaching for handball coaches**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 10 May 2025.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through http://www.aut.ac.nz/research/researchethics

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee

Cc: Eoinmurray8@gmail.com

Participant Information Sheet

Date Information Sheet Produced:

10/05/2022

Project Title

Technology enhanced, interactive remote training and teaching for handball coaches.

An Invitation

My name is Dr Eoin Murray, a coaching lecturer for the International Handball Federation and AUT Masters of Sport, Exercise and Health student. This project is part of my dissertation to complete my masters and is looking at introducing technology to increase the interaction and improve learning outcomes in remote handball coach education. I would like you to participate in a short handball coaching course in which you will receive coaching education via a number of routes including pre-recorded video and live interactive video watching session and live remote instruction. Whether you participate in this project or not and regardless of the outcome you will not be disadvantaged in any future coaching education.

What is the purpose of this research?

Handball coaching education requires a large proportion of practical training outside of the classroom which is not possible when the educator and participants are at a distance. I believe that using pre-recorded video or description of training is limited. This study aims to investigate the impact technology has on people's coaching practice and learning and its effect on interaction and learning outcomes in practical, remote sports coach education. The findings of this research will help to grow our understanding of best practice and cutting-edge coaching methods and allow coaches and educators to connect from afar.

How was I identified and why am I being invited to participate in this research?

You are invited to participate as a prospective and/or current coach of handball in Australia. Preference will be given to those who are or have been involved in handball as a player, administrator or coach or are teaching handball as part of an educational curriculum.

How do I agree to participate in this research?

You can accept/apply to participate in the course by filling out the attached consent form and returning it and if you are accepted to the course you will be notified by email in due course. Your participation in this research is completely voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you in any way in your club or Handball Australia. You are also able to withdraw from the study at any time without reason. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

In this project you will be asked to participate in a handball coaching education project involving practical learning components which will be delivered via mixed delivery methods which will include pre-recorded video, interactive video watching sessions and interactive technology-assisted coaching. You will be asked to compare your perception of learning and interaction during remote coach education while watching recordings of narrated coaching sessions, interactive recordings where you will be able to ask questions live and interactive coaching sessions where you will be receiving assistance while you conduct a training session. I will collect your reactions via interviews and questionnaires and will assess learning outcomes during the interactive sessions.

What are the discomforts and risks?

There are very minimal risks and discomfort involved. Interactive learning sessions will be recorded for quality and analysis purposes. You will be required to coach a handball session with other participants under instruction during the interactive session which will be streamed to the researcher to allow for educational intervention. Additionally, interviews will be audio recorded to ensure correct transcription. Online video interviews will only be video recorded if you wish.

How will these discomforts and risks be alleviated?

During the interactive part of the project will be fully supervised with interactive instruction and explanation to ensure minimal discomfort to you. Questionnaires will be anonymous and interviews will be conducted with me, the primary researcher, only.

What are the benefits?

There are a number of benefits for you in this project. You will receive education in handball coaching from a top handball educator that will benefit your coaching and teaching. You will also be a part of furthering knowledge in the field of distance sports education and technology assisted learning. I will benefit by gaining insight into remote learning and interactive technologies to improve coaching education delivery and by gaining data for my masters dissertation.

How will my privacy be protected?

All participants private or identifying data will be kept strictly confidential unless the participant requests any results from the project be forwarded to a governing body or employer. Questionnaires will be anonymous. Participation in the trial will in no way prejudice or affect participation or the outcome of any current or future handball coach learning projects that participants or researcher take part in. Consent forms and any identifying data will be stored separately to data.

What are the costs of participating in this research?

There are no financial costs to participate in this research, however a time cost of 5-8 hours is envisioned.

What opportunity do I have to consider this invitation?

You will have two weeks to consider this invitation.

Will I receive feedback on the results of this research?

I will provide you with a one or two page summary of the findings after final results are analysed and written using the contact information you provide below.

Are there any conflicts of interest?

There are no conflict of interest for any of the researchers involved in this course. Any outcomes from this study will not be dependent on or form part of any other educational course nor will prejudice any further handball educational opportunities. All participants reserve the right to remove themselves from the project at any time. Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Associate Professor Kirsten Spencer, kirsten.spencer@aut.ac.nz and +64 (0)921 9999 Ext.7239*

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Associate Professor Kirsten Spencer, kirsten.spencer@aut.ac.nz and +64 (0)921 9999 Ext.7239*

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, *ethics@aut.ac.nz* , (+649) 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Dr. Eoin Murray, bnx3101@autuni.ac.nz,

Dr. Eoin Murray, the primary researcher, will the primary contact for you and other participants and will be running all of the sessions in this study and collecting and analysing all of the data from this project. He is a currently studying towards a Masters degree in Sport Exercise and Health at Auckland University of Technology. He has extensive biomedical, chemistry and materials science research experience as a research fellow over the last 15 years in Universities in Ireland, Australia, Germany, Singapore and New Zealand. He also has considerable experience in sports coaching and is a Commission of Coaching Methods lecturer for the International Handball Federation.

The project supervisor is Associate Professor Kirsten Spencer, and she will have oversight over the project. She is an Associate Professor at Auckland University of Technology where she leads the research team in Performance analysis, Sports Coaching and Youth Development. She is the President of the Oceania Society of Performance Analysis in Sport. She has spent the last nine years studying coach and player development in sport from the community to elite level. Identifying opportunities and implementing strategies with National Sport Organisations that enhance effectiveness and performance.

Researcher Contact Details:

Dr. Eoin Murray, bnx3101@autuni.ac.nz

Project Supervisor Contact Details:

Associate Professor Kirsten Spencer, kirsten.spencer@aut.ac.nz and +64 (0)921 9999 Ext.7239

Appendix C – Consent form

Consent Form

Project title: **Technology enhanced, interactive remote training and teaching for handball coaches**

Project Supervisor: **Dr. Kirsten Spencer**

Researcher: **Dr. Eoin Murray**

○   I have read and understood the information provided about this research project in the Information Sheet dated 22/05/2022.

○   I have had an opportunity to ask questions and to have them answered.

○   I am not suffering from heart disease, high blood pressure, any respiratory condition (mild asthma excluded), any illness or injury that impairs my physical performance, or any infection

○   I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed. In addition, video conferences will be recorded and transcribed.

○   I understand that videos will be taken during the practical sessions and that any videos produced during the course of the project will be used for academic purposes only and will not be published in any form outside of this project without my written permission.

○   I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.

○   I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.

○   I agree to take part in this research.

○   I wish to receive a summary of the research findings (please tick one): Yes○   No○

Participant's signature: ....…………………………………………………

Participant's name: ....…………………………………………………

Participant's Contact Details (email address):

…………………………………………………………………………………..

…………………………………………………………………………………..

…………………………………………………………………………………..

…………………………………………………………………………………..

Date:

Approved by the Auckland University of Technology Ethics Committee 22/05/22 AUTEC Reference number 21/448

Note: The Participant should retain a copy of this form.

Appendix D – Expression of Interest

EXPRESSION OF INTEREST

Technology enhanced, interactive remote training and teaching for handball coaches.

Dear participant,

Thank you for your interest in taking part in our project. We are aiming to design a new method to teach sports coaches remotely using low-cost, common technology and would like you to participate in our initial study. It will require 5-10 hours of your time and you will participate in a short handball coaching course with an internationally recognised handball coach lecturer using three different methods of technologically assisted learning and have the opportunity to give your feedback. Please take some time to carefully read the attached information sheet and if you are still interested in participating, please fill in this expression of interest form with your contact details and we will be in touch with you as soon as possible.

If you have any questions in the meantime about the project or your prospective role in it, please feel free to contact the researcher Dr Eoin Murray at any time: bnx3101@autuni.ac.nz. If you have any concerns about any facet of this project you can contact the Project Supervisor, Associate Professor Kirsten Spencer, kirsten.spencer@aut.ac.nz

Thank you for your time,

Eoin Murray

Name

Email address

Appendix E - Procedures

1) VIDEO LEARNING

All participants will be sent a video recording of a training session conducted by an internationally renowned coach that has previously been used in an educational context by international handball bodies. They will also receive a brief overview of the session and a questionnaire (or link to the online questionnaire) to comment on their participation and opinions on the session. The participants will be allowed to watch the video on their own time and will be asked to fill in the B) Video Learning questionnaire.

2) INTERACTIVE VIDEO LEARNING

All participants will be sent the questionnaire (or link to the online questionnaire) and an invitation to an interactive video call at which they will watch a pre-recorded video training session conducted by an internationally renowned coach that has previously been used in an educational context by international handball bodies and researcher will talk the participants through the session – the theoretical background and practical considerations – and will answer any questions the participants may have about the session. The participants will be allowed to complete the questionnaire C) Interactive Video Learning in private on their own time.

3) DIRECT REMOTE TEACHING

An arrangement will be made between the researcher and the participants to allow them to conduct direct interactive remote teaching. In this session, the participants will coach a training session on a topic of their choosing. The researcher will oversee the session via live web-camera link (mobile phone camera or sports camera or web camera or similar) and be in constant contact with the participant during the session via speaker or earphone or similar, to instruct and assist the participant with the coaching session. The participant will be asked to complete the questionnaire D) Direct Remote Teaching, on their own time following the session.

Following completion of all of the sessions the participants will be asked to complete the questionnaire E) Comparative Questions. They will also be asked to complete elective video interviews to add detail to their opinions or ask any questions they may have.

Video and Observation Protocols

Interactive video learning will be via Zoom/Teams/Skype according to participants wishes and will be recorded for analysis and quality improvement purposes. These sessions will only be involve the participants and the main researcher. Post study interviews will be audio recorded but will only be video recorded with explicit permission of participant. Direct remote teaching will be streamed only to the researcher but not recorded. Incidental participation will be minimised by using only videos already in the public domain (for video and interactive video learning) and using only participants in direct remote teaching sessions. All participants will be made aware in the information sheet and on the day (both allowing for opting out by the participant at any time) when and in what medium they will be recorded. Recordings will be stored separately from any identifying material including EOI.

Appendix F – Advertisement

52

Technology enhanced, interactive remote training and teaching for handball coaches.

With the current difficulties surrounding travel and the increasing insulation of communities, the need for quality sports coaches in all locations to allow the best sports experience for everybody is greater than ever before. However, for the same reasons, education of these coaches has become more difficult. To aid in this, we are aiming to design methods to teach sports coaches remotely using low-cost, commonly available technology.

We require sports coaches or educators with an interest in learning how to coach handball (any experience level) to participate in a short handball coaching course with an internationally recognised handball coaching lecturer using technologically assisted learning methods. If you are interested in enquiring further please fill in the attached Expression of Interest form or contact the researcher (Dr Eoin Murray, bnx3101@autuni.ac.nz) directly with no obligation.

Questionnaire

CONSENT

In providing my consent to participate in the above project. I declare that I have been informed of the aims, procedures, and my role in the project, as described in the Participation Information document.

I further acknowledge my understanding that:

- The project is for the purpose of research;

- The information I provide will be kept confidential, and safeguarded, subject to legal requirements;

- The possible risks associated with participation in the study (i.e., no risks beyond those of everyday living) have been made known to me;

- My cooperation is voluntary, and I am free to withdraw from the project at any time without penalty or prejudice;

☐ Yes, I consent

☐ No, I do NOT consent

A) ABOUT YOU

The following questions are intended to find out about you and your coaching experiences. In the first part of the survey, you will be asked some demographic questions.

There are no right or wrong answers in this survey. You are encouraged to provide an answer for all of the questions but are under no obligation to answer any question.

1. Age: What is your age (years)?

☐ I prefer not to answer

2. Gender Identity: How do you currently describe your gender identity?

☐ I prefer not to answer

3. Ethnicity: How you best describe your ethnicity (tick as many boxes as you like)

☐ Indigenous Australian

☐ Torres Strait Islander

☐ Australian

☐ New Zealand Maori

☐ New Zealand European

☐ Pasifika

☐ Other (please specify)

☐ I prefer not to answer

4. Location: Where are based?

☐ Australia (specify city)

☐ New Zealand

☐ Other (please specify)

5. Education: What is your highest level of education?

☐ Postgraduate

☐ Degree

☐ High School Dip

☐ Other (please specify)

6. Sports coaching education: have you participated in any sports coaching education/courses?

☐ Yes

☐ No

Details

7. Handball coaching education: have you participated in any handball coaching education/courses?

☐ Yes

☐ No

Please specify (date, educator, level)

8. Handball coaching experience: Have you experience as a handball coach?

☐ Yes

☐ No

Please specify (number of years, levels)

9. Handball coaching: Are you a current handball coach?

☐ Yes

☐ No

Please specify (club/school/team)

10. Handball coaching: Are you planning to coach a handball team in the coming year?

☐ Yes

☐ No

Please specify (club/school/team)

11. Handball playing: Have you experience as a handball player?

☐ Yes

☐ No

Please specify (years, level)

B) VIDEO LEARNING/INTERACTIVE VIDEO LEARNING/DIRECT REMOTE TEACHING

12. To what extent do you agree with the following

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	N/A
The technology used was easy to use and understand	○	○	○	○	○	○
I was able to undertake the session with technology I already owned	○	○	○	○	○	○
The session was clear and easy to understand	○	○	○	○	○	○
The session was informative	○	○	○	○	○	○
The session was an efficient use of my time	○	○	○	○	○	○
The session was interactive and immersive	○	○	○	○	○	○
The session covered any questions I may have had	○	○	○	○	○	○
I felt my coaching knowledge improved after the session	○	○	○	○	○	○
This method of learning is an appropriate method of teaching coaching practice	○	○	○	○	○	○
This method of learning is an appropriate method of distance education for sports	○	○	○	○	○	○
The session encouraged me to apply these methods in my own coaching	○	○	○	○	○	○

C) INTERACTIVE VIDEO LEARNING

12. To what extent do you agree with the following

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	N/A
The technology used was easy to use and understand	○	○	○	○	○	○
I was able to undertake the session with technology I already owned	○	○	○	○	○	○
The session was clear and easy to understand	○	○	○	○	○	○
The session was informative	○	○	○	○	○	○
The session was an efficient use of my time	○	○	○	○	○	○
The session was interactive and immersive	○	○	○	○	○	○
The session covered any questions I may have had	○	○	○	○	○	○
I felt my coaching knowledge improved after the session	○	○	○	○	○	○
This method of learning is an appropriate method of teaching coaching practice	○	○	○	○	○	○
This method of learning is an appropriate method of distance education for sports	○	○	○	○	○	○
The session encouraged me to apply these methods in my own coaching	○	○	○	○	○	○

D) DIRECT REMOTE TEACHING

12. To what extent do you agree with the following

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	N/A
The technology used was easy to use and understand	○	○	○	○	○	○

I was able to undertake the session with technology I already owned	○	○	○	○	○	○
The session was clear and easy to understand	○	○	○	○	○	○
The session was informative	○	○	○	○	○	○
The session was an efficient use of my time	○	○	○	○	○	○
The session was interactive and immersive	○	○	○	○	○	○
The session covered any questions I may have had	○	○	○	○	○	○
I felt my coaching knowledge improved after the session	○	○	○	○	○	○
This method of learning is an appropriate method of teaching coaching practice	○	○	○	○	○	○
This method of learning is an appropriate method of distance education for sports	○	○	○	○	○	○
The session encouraged me to apply these methods in my own coaching	○	○	○	○	○	○

E) COMPARATIVE QUESTIONS

(You can tick multiple boxes)

	Video Recording	Interactive Video	Direct Remote Teaching
Which method did you find more enjoyable and why?	○	○	○
Which method did you find more time efficient and why?	○	○	○

Which method did you find easiest to use and why?	○	○	○
Which method did you find the best learning method and why?	○	○	○
Which method encouraged or allowed you to apply what you learned to your own coaching the most and why?	○	○	○
Which method would you recommend/like to see in future coach education courses?			