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Technology-enhanced learning in coaching: a review of literature

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1 **Technology-enhanced learning in coaching: A review of literature.**

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Abstract

The purpose of this review was to address the central theme of technology-enhanced learning (TEL) in coaching. Technology-enhanced learning' (TEL), has become a widely-accepted term for describing the interface between digital technology and teaching. The aim was to consider the evidence of TEL in coach education, and where appropriate the wider educational field. The review sought to contribute to an evidence-base of suggestions that can be promoted and developed inside and outside of coach development structures and interventions for TEL. In addition, the review to outline future areas for research, and to stimulate debate about the implementation and effectiveness of technology-enhanced coach learning. The review utilised a critical methodology, using principles of systematic review to gather evidence pertaining to TEL in coaching. From this number and considering the inclusion criteria sixty-four articles were included and reviewed in detail. The review revealed how despite the use of technology in coaching, teaching and learning the evidence of their efficacy is weak, and the use of TEL in coaching requires further longitudinal research that considers learner, pedagogy and pedagogic design in context, in order to understand its potential impact on optimising coach development pedagogies, and therefore, contributing to a discourse of effective coach learning.

Introduction

Coach learning is fundamental to the development of high quality coaching (Townsend, Cushion & Smith, 2017; Stodter & Cushion, 2017). Consequently, research has attempted to understand the process of coach learning (e.g. Wright, Trudel & Culver, 2007), commonly by attempting to categorise sources of coaches' knowledge (e.g. Erickson *et al.*, 2008; MacDonald *et al.*, 2015) and understand the use of discrete learning practices such as reflection (e.g. Taylor *et al.*, 2015; Gilbert & Trudel, 2001). The emerging consensus is that coach learning remains an idiosyncratic and often informal process reflective of the complex reality in which coaches work. As a result, in recent years alongside the significant increase in the provision of formal coach education (Gilbert & Trudel, 1999), academic interest in coach education continues to grow. The substantial body of literature on coach development however demonstrates a widely-held dissatisfaction with traditional 'face-to-face' coach education opportunities (Stoszowski & Collins 2016; Cushion *et al.*, 2010), with 'learning' instead controlled and shaped within coaching sub-cultures by a power-dominated process of socialisation (Cushion, Jones & Armour, 2003; Piggott, 2011). Indeed, it is well established that informal learning experiences contribute more to the development of coaching knowledge and practice than formal education (e.g. Cushion *et al.*, 2003; Mallett, Trudel, Lyle & Rynne, 2009; Stoszowski & Collins 2016; *inter-alia*). This is because coach education programmes tend to be standardised, instrumental and often developed in isolation from the "messy reality" of practice (Cushion *et al.*, 2010; Jones, Morgan & Harris, 2012), with coaches often 'filtering' knowledge from coach education according to "what works" in their own particular contexts (Stodter & Cushion, 2014, p. 75).

There is, therefore, an ongoing concern to outline optimal frameworks for formal coach development (Williams, Alder & Bush, 2016; Stoszowski & Collins, 2014) that bring coach learning "under greater critical control" (Eraut, 1994, p. 62). An unfortunate consequence of this is a proliferation of 'effective' prescriptions *for* coach education despite little evidence of the impact of such pedagogies on learning. These have included various 'constructivist' approaches that have included attempts to situate learning through communities of practice (e.g. Stoszowski & Collins, 2014a) narrative approaches (e.g. Douglas & Carless, 2008), ethnodrama (Morgan, Jones, Gilbourne & Llewellyn, 2013) and problem-based learning (e.g. Jones & Turner, 2009; Driska & Gould, 2014). One such perspective that has gained traction within coaching is the increased interest in the use of technologies to facilitate and enhance learning (Stoszowski, Collins & Olssen, 2015). 'Technology-enhanced learning' (TEL), has

become a widely-accepted term for describing the interface between digital technology and teaching – replacing popular terminology such as ‘e-learning’, ‘learning technology’ and ‘computer-based learning’ (Bayne, 2015, p. 5). Research has suggested that coaches are increasingly open to the use of technology to support their development, which may be due to their preferences for informal, bespoke learning experiences (Trudel, Culver & Werthner, 2013; Stoszkowski & Collins 2016). It has been suggested that technology can be a useful and innovative means to support and structure coaches’ learning, through the integration of technology in the design of coach education pedagogy (Stoszkowski *et al.*, 2015).

However, research to support technology-enhanced learning in coaching is still a developing area (Stoszkowski *et al.*, 2015). While research (e.g. Stoszkowski & Collins, 2016) suggests technology is used both as a source of knowledge and as a resource for coaches who ‘self-medicate’ their learning needs, the potential for technology to support and enhance coach learning remains critically underexplored. This is particularly important considering the use of technologies in coaching and the wider educational field is outpacing the development of theoretical frameworks and any underlying evidence base supporting their use (Gunawardena *et al.*, 2009; Stoszkowski & Collins, 2014). It is not yet clear however, how best to support the integration of technology into coach development as a means of facilitating coach learning. Therefore, there is a pressing need for an evidence-base concerning how technology is currently used in coach learning and the impact of its use, as well as developing guidelines about how it might be integrated to improve and ‘enhance’ coach education and learning. The purpose of this paper is to address the central theme of technology-enhanced learning (TEL) in coaching. The aim is to review the literature concerned with TEL in coach education, and where appropriate the wider education and sport pedagogy fields. The review seeks to contribute to an evidence-base of suggestions that can be promoted and developed inside and outside of coach development structures and interventions for TEL. In addition, the review seeks to identify future areas for research, and to stimulate debate about the implementation and effectiveness of technology-enhanced coach learning. Central to the review is the taken for granted assumption that technology can ‘enhance learning’, hence questions about how technology enhances learning are important and as well as what value is being added.

Methodology

Procedure overview

The review utilised a critical methodology that drew upon the principles of a systematic review. Because of the extensive body of literature across the fields of education, technology and learning and the growing body of literature in understanding how coaches learn, the review was divided into a number of stages (cf. Cushion *et al.*, 2010). First, a descriptive map of the field of TEL was assembled. This included the synthesis of a wide range of empirical, conceptual and review studies in order to identify evidence as to ‘what works’ in applying technology to enhance learning across settings such as higher education, teacher-training and pedagogy. Research relating to the use of TEL in the broader education, pedagogy and technology fields, inclusive of critical reviews of the literature, conceptual dilemmas or issues and the underpinning assumptions of TEL as well as examples of best practice, principles and evidence *for* TEL were identified. Next, research was identified that investigated different modalities of TEL and its implementation to coaching, coach education and coach learning.

The second phase of the review comprised of analysis and synthesis of the included papers to form a review narrative. The literature was organised according to Kirkwood and Price’s (2014) conceptual framework. This framework identifies the following means of categorising research in TEL – operational improvement, quantitative change in learning, and qualitative change in learning (Kirkwood & Price, 2014). This enabled a structure to the discussions surrounding coach learning and TEL and also provided a framework to consider research from other relevant domains. The framework was a pragmatic conceptual tool to help organise a disparate body of literature.

Inclusion Criteria

The review considered the relevant English language research undertaken between 2010 and 2016 with a particular focus on technology-enhanced learning applied to coaching, coach learning and coach education, while including literature in relevant related disciplines (e.g. education, professional learning, and educational technology). The review considered research that was published in peer-reviewed scholarly journals as well as books/book chapters relevant to the research questions. TEL features prominently in disciplines such as professional learning and education and constitutes a large body of literature, and TEL itself is a broad term encompassing many modalities. For this reason, generating specific evidence regarding the impact of technology on learning, and also connecting coaching to the wider TEL field proved challenging. Whilst it was clear that many researchers were interested in the use of, and benefits for, implementing TEL, there remained very little evidence as to what ‘worked’ in specific

contexts with varying demographic populations. This process of gathering evidence regarding TEL and its application to coaching was monitored by three measures of quality against which each article was assessed (cf. Cushion *et al.*, 2010). These were:

- Trustworthiness of results assessed by the quality of the study (methodological rigour).
- Appropriateness of the study for addressing the research question (relevance).
- Appropriateness of focus for answering review question (topic relevance).

Search Strategy

The initial search strategy involved identifying databases relevant to the research (e.g. psychINFO, SportDiscus; ProQuest), using various combinations of key words (e.g. technology-enhanced learning AND coaching; technology-enhanced AND learning AND coaching OR education OR development). Once identified, an exhaustive search using these databases was conducted. This search was further supplemented by an extensive manual search across relevant journals in the fields of education, learning and technology, as well as that of coaching to identify relevant literature. This was not unproblematic, as despite the substantial body of literature investigating the use of technological resources to enhance learning outcomes across the field of education, coaching research that utilised technology was much more difficult to identify. In order to limit the numbers of relevant articles pertaining to TEL interventions papers that were subject specific were excluded (e.g. language learning; science; computer studies) but articles that were discipline specific were included (e.g. higher education; pedagogy; professional development).

As a result, two-layers of research were investigated, first; research relating to the use of TEL in the broader education, pedagogy and technology fields, inclusive of critical reviews of the literature. Second, research was identified that investigated different modalities of TEL and its implementation to coaching, coach education and coach learning. The initial search strategy involved reading the abstracts of selected papers against the inclusion and exclusion criteria, removing duplicate papers and compiling a database of research notes as to the key points of each paper. All articles without a clear focus on TEL related to the aims of the review were excluded. From the initial searches over 5000 abstracts were reviewed and yielded 262 papers to be read more closely. From this number and considering the inclusion criteria 64 articles were included and reviewed in detail. Ensuring the review was systematic and transparent presented challenges, particularly in identifying robust and defensible

inclusion/exclusion criteria, resulting in a tension between inclusion and research that was useful, relevant, and having an impact on the field. For this reason, judgement of value was based on an aggregation of methodological quality, methodological relevance, and topic relevance (cf. Cushion *et al.*, 2010).

Analysis

The papers were analysed deductively against Kirkwood and Price's (2014) organising framework. Each article was read several times in order to become familiar with findings about enhancements and the evidence presented to support these claims. Each author read the articles independently and noted salient points relating to (1) the driver for the intervention/study, (2) the enhancement sought, (3) the research/evaluation approach and methods, and (4) the type(s) of evidence acquired. As part of the analysis the role of technology were considered in terms of three outcomes; first, replicating existing 'teaching' practices, second, supplementing existing teaching practices, and lastly transforming teaching or learning processes (cf. Kirkwood & Price, 2014). Replicating existing practices involved an element of 'conventional' delivery that was copied and delivered using a form of technology. Supplementing practices involved resources or tools being made available to increase flexibility for learners, with the research examining the response to the increased flexibility. Transforming practices involved a structural change in the teaching and learning process using technology (see table one below).

Insert Table 1 here

Furthermore, the literature often identified more than one 'enhancement' for example, increases in peer-to-peer learning and critical thinking – and therefore the research was organised into; operational improvement, quantitative change in learning, and qualitative change in learning (cf. Kirkwood & Price, 2014). Table 2 below lists and maps the studies conducted in coaching relating to the enhancement identified – the gaps denote no studies conducted in coaching reporting the particular conception of enhancement.

Insert Table 2 here

Table 1 served as a map of the intervention studies according to their use of technology, while table 2 enabled us to map an understanding of how enhancement was conceived. Overall, as can be seen, most papers were concerned with enhancement as qualitative changes in learning, or operational improvement. Only one study sought to demonstrate a quantitative change in

learning, and while two studies reported qualitative changes in learning while using quantitative data collection methods.

Overview

The following overview is organised into three parts. First, the TEL interventions in coaching are mapped and reviewed against an organising framework utilised in the wider educational literature (Kirkwood & Price, 2014). Next, the wider educational field (including physical education and sport pedagogy) is reviewed to attempt to synthesise and draw out some recommendations for best practices in the use of technology to support and enhance learning. Finally, we discuss methodological, theoretical and practical issues related to research on technology-enhanced learning applied to coaching, offering some recommendations for developing a research agenda.

Qualitative Change in Learning

Kirkwood and Price (2014) suggest that a qualitative change in learning with the use of technology promotes reflection on learning and practice, deeper engagement, and richer understanding. For example, Stoszkowski and Collins (2015) and (2014) analysed the content of twenty-four and twenty-six undergraduate students' online blogs to examine the quality of reflections and the extent that blogging promoted higher-order thinking. In the 2014 study descriptive reflection exceeded higher-order thinking and reflection, though the blogs showed a trajectory toward higher-order thinking. While the blogs provided an effective platform for supporting tutor-student interaction an online community did not emerge. The authors suggest that sporadic use of the blog and a lack of a reflective structure inhibited the process of reflection. Moreover, simply providing access to peers was insufficient to promote peer-to-peer engagement and develop a learning 'community'. In the 2015 study the authors used a framework of knowledge typologies to analyse and classify blog entries and found an improvement in higher-order thinking processes and reflection but that these were variable and progressed in a non-linear fashion. The authors did report an increase in peer collaboration and posited the creation of a 'community of practice' as the tutor and supporting structures provided a clear guide. However, in line with research in the wider educational literature (e.g. Hew & Cheung, 2013), because of the research design the authors were unable to clarify if the improvements were due to the blogs themselves or the way that the collaborative tool was used.

In a further study, Stoszkowski *et al.* (2015) sampled twenty-three undergraduate student coaches to take part in four semi-structured focus group interviews gauging their perceptions about the use of group blogging for reflection and learning. Participants reported positively about their experiences and indicated improvements in reflection, knowledge acquisition and their coaching practice. The authors suggested that the formal structure provided by the course and tutor and peer support were key mechanisms in facilitating reflection. Moreover, the format and accessibility of the platform on mobile devices and ability to engage in the work asynchronously was outlined as helping student uptake. These findings were balanced with participants having time and the ‘attitude’ to engage with the group blog as well as issues with group dynamics and group sizes. The authors pointed out that the technology was enabling of learning rather than being the mechanism for learning itself, a finding echoed in the wider educational field (e.g. Hannafin & Land, 1997).

Jones and colleagues (2015) examined the use of video diaries to support coach learning and reflection using evidence from a long-term (three year) case study tracking twenty-seven coaching students through their undergraduate coaching course. The authors challenge some of the positive claims surrounding the use of video diaries showing their use produced less engagement with reflection than written logs and group discussion. The perceived burden of completing entries was highlighted as outweighing the perceived benefits of using the approach. As a result, the production of video entries then became mediated by tutor involvement. The authors pointing out that it is important to consider “with whom and in what context will they be used, factoring in issues of time, inclination and general enthusiasm from potential respondents” (p. 407) as well as optional versus compulsory use. Furthermore, Mead, Spencer and Kidman, (2016) interviewed six performance-level coaches in four invasion sports about their perceptions of the use of video self-reflection as a tool for learning within their ongoing development. Contrary to Jones *et al.* (2015) the authors highlight the positive reception use of video technology to support reflection, but also indicate time and a lack of training/experience as barriers to its use.

Partington *et al.* (2015) tracked the coaching behaviour of five elite football coaches over three seasons (approximately 30 months) using a computerised observation system (Coach Analysis Intervention System, CAIS) (Cushion, *et al.*, 2012) and video feedback. The study reported significant differences in four behaviours, instruction, feedback, silence and questioning. The authors reported that the use of objective data and video feedback provided a

structure for reflective conversations, improved self-awareness and provided a trigger for behaviour change evidenced over the duration of the research. In a similar vein, Kuklick, Gearity and Thompson (2015) monitored the reflective activity of twenty-one coaching students over a 12-week practicum. The students used an online journal and responded to weekly reflective prompts that were posted by course tutors. Students completed the self-reflection and insight scale (SRIS; Grant, Franklin & Langford, 2002) and the quality of reflection was measured using an adopted reflection rubric. Pre- and post-test scores from the SRIS showed a significant improvement in measures considering intrapersonal knowledge and an increase in the levels of reflection from the rubric. The authors also highlighted the use of technology as a means to facilitate better connections between students and tutors.

Quantitative Change in Learning

Kirkwood and Price (2014) suggest that quantitative changes in learning tend to be interpreted as an improvement in the acquisition or retention of knowledge, increased engagement or time-on-task and students achieving improved test scores or assessment grades. In the only study to take this approach, Glang *et al.* (2010) designed an online education course for youth sport coaches. The course was designed to develop sport concussion prevention and management practices. The authors developed a short three module online resource that included scenarios. Seventy-five coaches took part in a randomised control trial with pre-and post-test measures. Significant differences were reported between treatment and control participants on measures of: (a) knowledge about sports concussion, management, and prevention; (b) attitudes about the importance of preventing sports concussion; and (c) intention and self-efficacy in sports concussion management and prevention. The authors argued that the results illustrated the course had an impact on understanding – though acknowledge that the study cannot suggest the extent that the coaches would use the skills or knowledge in practice.

Operational Improvement

Operation improvement refers to the potential efficacy of TEL in coach learning and development. For example, Hay *et al.* (2012) proposed using Web 2.0 technology to develop assessment of coaching practice as learning experiences. Drawing on protocols for online clinical assessment of practical skills in sports medicine, the authors suggested a three-stage model that included tutor exemplars as a reference point for learners, learner-generated video

of practical skills with tutor feedback, and real-time video conferencing summative assessment of practical skills. Despite no evaluative research design, Hay *et al.* (2012) argued that the technology has the potential to facilitate a shifting of responsibility to the coach in the context of their development. Kuklick *et al.* (2016), based on feedback from a case study with a single coach, highlighted the potential for technology-based learning community meetings to connect coaches with trustworthy and knowledgeable facilitators and peers in a manner that fits with the coaches' busy schedules – and hence the potential for such technology to promote coach learning effectiveness.

Use of Technologies

Analysis of the limited literature and evidence available on technology in coaching and coach development suggests that technology offers a means of increasing the efficiency of existing coach development processes, enhancing reflective practices or offering a means to transform coach education pedagogy. However, the limited evidence on coaching means that it is difficult to synthesise and draw out best practices or evidence pertaining to different modes of technology to enhance learning. There is a wide range of Web 2.0 technologies available for use in learning, however in coaching, technology is commonly used to replicate or supplement traditional activities through online reflection, social spaces, online collaboration or online delivery (Hew & Cheung, 2013). In the next section, we consider the literature from education and sport pedagogy in an attempt to synthesise recommendations for the integration of technologies into coaching and coach development. Hew and Cheung (2013) reviewed twenty-seven articles considering the use of Web 2.0 technology in higher and secondary education – they identified podcasts as the most commonly investigated, with investigations also considering, blogs, wikis, social media and virtual (learning) environments (VLE). In the next section, each use is now considered.

Podcast

Evidence from educational research suggests that podcasts with supporting materials have reported generally positive results compared to just 'lectures' or 'traditional delivery (Hew & Cheung, 2013). The positive results stem from learners receiving additional relevant information or content. However, in their review, Hew and Cheung (2013) reported that positive effects are not attributable to the podcast *per se* but how podcasts are used. For example, when podcasts provided additional support to 'classroom' only instruction

improvements were noted – when groups received the same information none or trivial improvements were reported. All of the research reports on tutor created material – no research has considered the impact of learners developing their own original material, but this is posited as having potential for developing learner ownership and deeper engagement (Hew & Cheung, 2013). No empirical findings support this and it is therefore an area for further exploration.

Wiki

Research examining the use of wikis is underdeveloped with relatively few studies being undertaken. Those conducted in education have reported mixed results – with improvements assigned to pedagogical design rather than the use of technology in itself (Hew & Cheung, 2013). Poor research design (e.g. lack of pre-tests, single groups) and confounding variables such as different tutors involved with courses and increased staff-student ratios compared with courses not using wikis have also been identified as issues in terms of the impact on learning. In a sport related study, Hastie *et al.* (2010) implemented wiki technology with two classes of secondary school physical education pupils to design a new invasion game. Data were collected using a reflective log and interviews. The authors reported use of the technology asynchronously (24/7 classroom) and an extended learning community beyond the classroom. The authors make the case for a ‘higher quality learning experience’ suggested by increased engagement provided by the technology and student ownership of the task.

Blogs

In a similar vein to the coaching literature, gains in learning have been reported through using blogs in the wider educational context, particularly linked to learner writing, peer-to-peer learning/ peer interaction, and critical thinking – these conclusions however have to be treated tentatively because of research designs based on single cases and a lack of pre-intervention data (cf. Hew & Cheung, 2013). Hence it is not always clear if learning gains can be attributed to blogs alone, as blogs are often scaffolded with additional guidance and support. For example, Olofsson, Lindberg and Huage (2013) observed that it was difficult to assess the impact of blogs as a singular approach when it was part of podcasted lectures, course readings and other learning resources. Furthermore, Fakude (2014) observed that in implementing blogs as a reflective and collaborative tool with student nurses, while initially useful as a platform for sharing reflections, not all participants were comfortable using the technology and its use was impaired by limited engagement.

360 *Social Media*

361 Social media have been used for a range of activities, these include discussions and question
362 and answer, sharing materials, providing support, and organising groups. In their review Hew
363 and Cheung (2013) suggest social media can assist in developing conversations between
364 educators and learners and between learners. So far, no research has been able to link changes
365 in learners or learning to the use of social media specifically as opposed to the increased
366 engagement with tutors through, for example course design. In a sport related study, Goodyear,
367 Casey and Kirk (2014a) looked at the interactions between five physical educators and a
368 facilitator over a two-year period. The authors investigated social media as a means for a
369 facilitator to support multiple teachers in a virtual location overcoming issues of time and cost.
370 The researchers used social media to support in-school activity, and the authors claim this use
371 became a form of inter- and intra-professional reinforcement leading to the development of
372 professional learning and supporting pedagogical change. As with the wider literature, the
373 research design means that causality is difficult to establish, that is, not the technology alone
374 but the level of support could be responsible for the positive findings.

375 *VLE/MOOC*

376 Massive, open online courses is positioned in the wider educational field as difficult to tell if
377 they “constitute a revolution in higher education or just a fad” (Steffens, 2015, p. 52).
378 Kartensi’s (2013) review considered 100 studies on the use of MOOCs and found that the
379 advantages of MOOCs are associated with traditional distance learning (e.g. increased
380 accessibility of course material, asynchronous access, access materials multiple times, self-
381 paced), that success rates among MOOC participants is in general low, assessment and links to
382 certification are problematic, and it is difficult to ensure learning support, requiring learners to
383 be highly autonomous. Flavin (2016) suggests that MOOCs are most suitable for those with a
384 grounding in the subject with up to 85% of participants already having a degree – while
385 specifically targeted MOOCs compromises the openness aspect of MOOCs. Democratising
386 access to resources is not the same as access to education (Flavin, 2016). The MOOCs may be
387 useful to support CPD where the outcome of learning adds value to existing professional
388 practice – thus limiting the openness to organisational contexts.

389 *Web 2.0 and Blended Approaches*

Papasterigiou & Gerodimos (2013) used a web-based multimedia course to teach PE teachers to teach basketball. A blended learning approach using the web-based course in combination with face-to-face instruction was significantly more effective than conventional face-to-face alone. Russell *et al.* (2014) implemented a blended online ‘physical activity and wellness’ course to replace a previously delivered ‘face-to-face’ programme. The authors reported positive effects associated with distance learning, that is increased accessibility of course material and asynchronous access, students able to access materials multiple times and for students to be self-paced through the programme. Szabo & Schwartz (2011) blended on-line discussion forums into a ‘traditional’ face-to-face delivery and reported that this developed learner’s critical thinking skills and improved the quality of written reflections. The authors suggesting that on-line tasks need to be purposeful and connected – intervention from the instructor is required, modelling comments, asking higher order questions and prompting learners to sharer reflections and experiences.

Kori *et al.* (2014) reviewed thirty-three articles that considered blended technology supporting reflection in teachers described as ‘technology-enhanced learning’. The authors considered ‘technical tools’, some kind of instrument that supported reflection, with the tools identified as video, blogs and e-portfolios. Video was used to situate learning, develop habits of reflection and develop self-awareness – which aligns with the reported work in coaching. For example, Walters *et al.* (2015) used a qualitative case study to examine how a learner-generated video assessment developed critical thinking and engagement with theoretical concepts, interview data along with improved grades suggested this was the case. However, the authors pointed out importantly that the alignment of learning strategies and assessment methods were the drivers for learning ‘transformation’ rather than the technology alone. In a different sport related study, Goodyear, Casey and Kirk (2014b) used a co-operative learning model with video to teach an eight-lesson basketball unit to adolescent girls ‘disengaged’ from physical education. The findings suggested that the use of technology supported the learning design and an opportunity for participants not to engage in the physical aspect of learning the sport – the authors suggesting that partial engagement has the potential to provide a gateway to full participation. Similarly, Casey and Jones (2011) used video for eight weeks with a class of year seven mixed gender students identified as ‘disengaged/underachieving’. The video was used with the primary purpose of increasing engagement. The authors reported that the use of

video provided a support to the learning environment and a support for discussion and engagement with disaffected students.

Kori *et al.*'s (2014) review showed that added predefined guidance and tutor interaction increases effectiveness of the use of technology. The authors identified prompts, guiding questions, and predefined guidance as giving structure and setting limits to learning – while giving depth to critical thinking, helping cement new knowledge and support learning activities. Human interaction took the form of interaction with peers, tutors or mentors. However, most of the research evidence supporting this approach – as with the coaching research – is derived from self-report or participant perceptions. Research that has compared, for example, online blogging with peer comments to traditional essay writing with small group discussion has found no significant difference in student learning. Therefore, technical support alone may not be effective in supporting learning and predefined guidance and human interaction is needed. However, such was the variability of findings there is no conclusion about what type of support works best (Kori *et al.*, 2014). As Lu and Churchill (2014) pointed out, increased social interaction afforded by a social networking environment can be short lived, individual-centred and casual. These authors state that for enhancement to take place there is a need to prescribe learning tasks that show examples of good practice, including authentic tasks, and rewarding good efforts. The authors also argue that a blended approach through multi-channel social interactions support diverse media preferences. The results reported in the literature further highlights the need to consider the wider pedagogical scaffold in which technology fulfils an integral function; that is the interaction between the learner, the learning environment and the intended learning outcomes and the potential role of technology in facilitating these. In addition, while some empirical data are presented some research only presents argumentative discussions that lack empirical support or evidence.

Discussion

This review of literature has identified a number of issues that warrant closer scrutiny. Specifically, these relate to methodological, conceptual and practical issues related to TEL in coaching. The review demonstrates clearly that “educational technology is not a homogenous ‘intervention’ but a broad variety of modalities, tools and strategies for learning” (Ross, Morrison & Lowther, 2010, p. 19) that is often used in a ‘mixed’ or ‘blended’ fashion. Therefore, this next section of the review considers the ways in which TEL is conceptualised,

different forms of evidence used to substantiate claims about TEL, and practical issues related to implementing TEL in coaching.

Methodological Issues

The lack of a structured research agenda and longitudinal methodologies means that there remains a scarcity of published work in coaching that links evidence of the application of technologies to enhancements in learning. As a result, observed outcomes can be attributed to a ‘novelty effect’ where participants react positively to any new intervention regardless of its merit (cf. Hew & Cheung, 2013), an issue identified in research in sport (Casey, Goodyear & Armour, 2016). The question of how ‘improvement’ is measured and defined also remains, with authors commonly identifying deeper and critical thinking and peer interaction as outcomes equated with learning (e.g. Mendenhall & Johnson 2010; Lu & Churchill, 2014), an approach similarly reported in the coaching literature. Indeed, very few studies in the sport, coaching or wider educational literature attempted to explain changes in *learning* as a result of a TEL intervention, with much of the focus on improving peer-to-peer and tutor interaction and learner ‘engagement’ and ‘learning’ assumed to be a by-product or proxy of these outcomes. The absence of empirical research that tracks learning through sustained exposure to TEL environments is clear and provides stimulus for further research.

As a result, research designs are often reflective of a deterministic expectation that technology by itself will bring about changes in learning and practice (cf. Kirkwood & Price, 2014). Across the coaching literature (and the wider educational field) much literature has been essentially descriptive and promotive (Hastie *et al.*, 2010) with most articles simply reporting the utility of using technology, with examples of contexts and suggestions for use. Increased flexibility for learners supports operational goals and does not inform about learning, but can be taken as a proxy for learning by participants (Kirkwood & Price, 2013). The relatively modest body of work in coaching attempted to highlight how technology was used, what activities were most valuable, and what advantages/disadvantages the technology presented for the learners’ experience, or attitudes toward a particular technology. While useful, these outcomes do not demonstrate that technology has enhanced or contributed to ‘learning’ as the studies typically rely on self-reports of perceptions and attitudes by tutors and students. Determining perceptions can provide useful information in terms of the value and interest of technology in the design, implementation or operational improvement of pedagogical

environments. However, when considering participant ‘learning’ the research has so far failed to demonstrate evidence of participants’ changes in knowledge as a result of technology integration. The underlying assumption in much of the research is that expressions of attitudes can be equated with learner enhancement – however on a closer inspection it is “inappropriate to conflate attitudes with learner development” (Kirkwood & Price, 2013, p. 542) – making judgements about effectiveness difficult.

A common research approach in education involves comparing the outcomes from teaching one group using technology with those of a non-intervention group or ‘control’ who are taught with more conventional means such as classroom instruction (Kirkwood & Price, 2013). However, the coaching literature often relies on ‘single group’ research designs, where reported changes in learning are not necessarily due to the manipulation of the technology, hence increasing the difficulty of attributing changes to the intervention. True experimental comparisons however, are not easily achievable in coach education settings and results in quasi-experimental approaches being adopted where the pedagogy is not just technologically-enhanced but the nature of the intervention supplements or changes the mode of teaching. Causality is then difficult to attribute if variables are not held constant – when additional or supplementary resources or tools are provided any enhancement observed might simply be attributable to the additional inputs or time spent on task rather than the technology being the mediating factor (Kirkwood & Price, 2014). Moreover, learning has a temporal nature, in that deeper or richer understanding, for example, may not present itself until sometime after the intervention. Therefore, perspectives regarding evidence are not just methodological. They also encompass different views about learning, where this may be characterised as qualitative changes in development relative to the individual, or quantitatively in terms of ‘exit behaviours’ that are the same for everyone. Therefore, concepts of evidence are linked to fundamental beliefs about coaching and learning and what constitutes evidence (Price & Kirkwood, 2014).

Conceptual Issues

Casey *et al.* (2016) suggest that few educators are able to incorporate technology into the pedagogical context in purposeful ways, which means that in coaching, technology mediated teaching and/or learning is not a mainstream practice. Part of the problem is the lack of clarity around what is meant by ‘technology’ and is often taken to focus on the role of technology as a supportive mechanism for already-existing educational activities (Bayne, 2015; Flavin,

2016). As Bayne (2015) suggests, technological variety and multiplicity are ‘black-boxed’ and separated from the social context and not understood as social objects – and the underlying assumptions are simplistic and ‘common-sense’. The assumption in much of the existing literature is that technology can enhance pre-existing objectives (a perspective characterised by instrumentalism), and learning can be transformed by the immanent pedagogical value of technology simply by using them. There is, therefore, an inherent conservatism in the discourse where enhancement assumes the efficacy of the pre-existing pedagogical practices which are not in need of radical shift or displacement but can simply be made better by the application of technology (Bayne, 2015) – there is a danger in coaching that technology could be used as a substitute for poor coach education practice – that is, ‘doing things better, rather than doing better things’ (cf. Kirkwood & Price, 2014). Rather than reconstruct educational programmes, the assumption is improvement and consolidation via the utilisation of technology (Bayne, 2015). This means that applying technology uncritically within established pedagogical models is problematic because the technology gets manipulated to suit existing pedagogy and is subsumed within an existing pedagogical model (Flavin, 2016). Therefore, there is a gap between the features of technology and the use of technology – with the technology offering a more efficient method but is ultimately static in developing learning as existing pedagogies are relocated to the technology.

Another conceptual issue with the use of technology to enhance coach learning is the difficulty with generalising findings across contexts. Thus, while interventions often focus on the specific application of a technology, details of the teaching and learning interactions, and the social context in which it is situated, are required to understand the context of implementation. In addition, the term ‘enhanced’, while widely used, is frequently used in an unconsidered and unreflective way with its meaning taken for granted. Therefore, there is a need to avoid the tendency to ‘glorify’ the capacity of technology to impact learning, conceiving technology as a ‘super tool’ (Casey *et al.*, 2016; Price & Kirkwood, 2014). Moreover, the impact on learning will be dependent on how learning is conceived and understood. Decisions about when to use technology, what technology to use and for what purposes cannot be separated from theories and research on learning, instruction, and assessment (Lawless & Pelligrino, 2007). Technology is only as good as “the pedagogical methods it employs” (Ferster, 2014, p.176).

Practical Issues

Although most TEL applied to coaching projects are relatively small-scale and context-specific, the cumulative lessons learned can provide a useful indication of the benefits of integrating technological tools and resources into coach education and development contexts. From the review, practical benefits of TEL were identified as a means of supporting collaborative learning and peer-support across large cohorts, as technology can enhance communication, knowledge and resource sharing, and engagement in learning environments. Indeed, the addition of technology provides opportunities for flexible, diverse and interactive approaches to assessment, and can be conceptualised as ‘learner-centred’ in that learners can self-regulate the management of learning activities through asynchronous and flexible access to learning materials (Keppell, Suddaby & Hard, 2015; Lu & Churchill, 2014).

However, it must be noted also that technology integration can present a number of practical and logistical challenges. Casey *et al.* (2016) argue that while there is a generation of active users and consumers of technology, some educators are resistant and struggle to integrate technology in pedagogically sound or innovative ways. For example, there are specific costs to using technology: site licence, administration, technical support, hardware, technology infrastructure, course development, tutor and learner training. The time and effort to overcome possible resistance to new technology and procedures is also a cost factor (Flavin, 2016). In addition, there is limited research to support the notion of a ‘digital native’ with the picture more nuanced depending on confidence and whether a passive or active user of technologies – use of technology in learning when not specifically structured is logistical rather than participatory (Flavin, 2016). Research evidence also suggests learners, while enthusiastic users of some technologies (e.g. social media), would not be in favour of these as a teaching tool – suggesting learners practice demarcation in the use of technology (Bayne, 2016).

Conclusions

Technology-enhanced learning environments afford opportunities to expand our existing models of coach development, but, do not impose the explicit conditions for learning (cf. Hannafin & Land, 1997). Technology can be used to compliment traditional learning environments by providing parallel synchronous and asynchronous learning spaces (de Andres Martinez, 2012). Importantly, effects on ‘learning’ are not necessarily related to the technologies themselves but how the technologies are used, as “technologies are not a silver bullet and will not independently or autonomously improve learning performance” (Hew & Cheung, 2013, p.58). Thus, when considering the use of technology in coach education,

pedagogical and instructional strategies need to be developed alongside technologies as pedagogical design is the major factor impacting learning in a TEL environment, including how both tutors and learners are required to adjust to TEL environments compared to traditional ‘classroom delivery’ (Hsu *et al.*, 2012).

In technology-enhanced learning environments, the processes associated with understanding and the contexts in which it occurs are linked. They emphasize not only assimilation but the development of meta-knowledge for both solving existing problems and generating new ones. Through experience, learners become increasingly facile with available tools and resources, and skilled in assessing how and when to employ them (Hannafin & Land, 1997). An effective learning environment encourages learners to use its resources and tools to derive problems, vary solutions, and “expand the boundaries of their understanding” (Hannafin & Land, 1997, p. 187), the review suggests that there needs to be a clear alignment in the pedagogical environment between the learners, the learning outcomes and the modes of technological transmission utilised to achieve these. Technology-enhanced environments often provide the conceptual scaffolding and means (e.g. platforms, resources and tools) to promote personal and individual reflection. In this sense technology should be thought of as an enabling tool to promote learning (Hannafin & Land, 1997). However, facilitating coach learning remains a complicated practice that requires the interweaving of many kinds of specialised knowledge. In their application to coach development, TEL can potentially provide interactive environments that enable individuals to address unique learning interests and needs, study multiple levels of complexity, and deepen understanding (Hannafin & Land, 1997). Furthermore, it is suggested that the use of TEL establishes the conditions that “enrich thinking and learning, and use technology to enable flexible methods through which the processes can be supported” (Hannafin & Land, 1997, p. 168). However, the evidence base that supports this in coaching is currently fragmented and weak. Consequently, apart from isolated studies, comparatively little understanding of the role, function and impact of technology in the design of coaching specific learning environments has evolved.

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