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Developmental pathways in netball match officiating: examining the potential role of technology

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ABSTRACT

Research aim: This research sought to explore the role of technology within development pathways in netball match officiating.

Research methods: A qualitative methodology was employed to gain insight into technology within development pathways. 28 participants were sampled across the five global netball regions, fulfilling single and mixed umpiring ($N = 21$), assessing ($N = 7$), coaching ($N = 5$), tutoring ($N = 5$), mentoring ($N = 3$), administration ($N = 3$), and bench officiating ($N = 1$) roles, with thematic analysis using inductive coding adopted to investigate perspectives specifically towards technology use.

Results and findings: Video within assessment processes and its implementation in analysis practices was highlighted as important for providing effective feedback. The effect might not be due to the technology alone and interactions between the individuals providing and receiving feedback should also be considered. Creating learning provision, enabling the sharing of resources and greater access to development opportunities were discussed as crucial, especially in developing world regions. However, socio-cultural differences might impact upon personal preferences in using technology or its perceived need, and regular monitoring of provision is crucial to ensure impact is occurring. Adopting processes to share knowledge across regions and creating greater assessment and mentoring opportunities were also seen to enhance development and learning. Implementation of technology should be considered in relation to different stages of development that are apparent across nations, with factors such as cost, required skills, and the compatibility being crucial to ensuring needs are met appropriately.

Implications: The findings identify how technology could act to benefit match officiating pathways. The crucial factor is ensuring that equity is sought in providing mechanisms of this manner, adopting policies that are aimed at effecting the global development landscape. This might, however, be impacted by cost and availability, and as such considerations need to be made towards accessible opportunities, irrespective of geographical location.

Research contribution: This research provides detail on the role of technology within development processes of sport officials and in a previously under researched sport.

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Introduction

The development of match officials is a crucial aspect of the progression and enhancement of sport. Ensuring that appropriate opportunities and structures are accessible to match officials enables such progression to occur. Webb et al. (2021) highlighted the need for support structures to be in place to help officials progress through pathways, promoting more consistency in development. Furthermore, benefits have been reported in incorporating development opportunities within support processes (Webb et al., 2019), which in turn could enhance pathways on a wider scale. There are, however, many facets to the development of match officials, including physical, psychological, and decision-making aspects, all of which are imperative to the performance of these individuals, as are the development of appropriate training environments (Cunningham et al., 2022). Whilst these points allude to the need for somebody to provide support or training in the presence of a mentor or coach to create an effective environment, development processes that are home-based are now a reality (Samuel et al., 2022), something aided greatly by the adoption of technology.

With technology promoting a variety of benefits to enhance development processes, it is apparent that the influence of such integrations could be widely adopted by organisations and governing bodies. Ratten (2020) discussed how technology could act to influence communication on a broader scale, where knowledge could be integrated from a range of sources and collected over larger distances. This in turn could influence outreach to a wider community and promote greater inclusivity (Ratten, 2020). This growth in access has also helped to identify how learning can occur across time and settings, acting to create personalised learning opportunities, where instruction and support mechanisms can be tailored to the needs of the learner (Darling-Hammond et al., 2020). Continuing to develop technology was discussed by Smoyer et al. (2021), who stated that such developments could expand greater organisational effectiveness and development of workforce capabilities. Benefits are apparent in technology and support the transfer of knowledge, but the importance of people in the process is crucial in creating mechanisms to ensure knowledge is conveyable from setting to setting (Schenk et al., 2015).

Technology platforms have been perceived positively in terms of their impact on communication, productivity, and enhancing the accuracy of information provided (Best et al., 2021). Methods of communication appear to have benefited significantly from developments in technology (Lucas et al., 2021), by providing greater ease of communication, in a sport governance setting (Ferkins & Shilbury, 2015). Governing bodies play an important role in delivering development opportunities, where the adoption of technology has enabled mutual responsibility in their management, especially with the use of online platforms (Willem et al., 2019). These processes have been highlighted with reference to match officials. The adoption of technology platforms and tools in development pathways appeals to younger officials and fosters progression through such pathways, conducive with social norms and enabling alignment of geographical areas more effectively (Sam et al., 2018).

Ensuring that adequate support can be fostered with the employment of technology is a key consideration, particularly in ensuring that movement through development pathways can be achieved (Forbes & Livingston, 2013). Considering how support and mentoring effect development, Livingston et al. (2017) raised the question of how technology fits into this process, particularly with a focus on the importance of long-term development of sport officials. Mentoring has been widely reported as a key component to the

development of match officials, acting as an important process in long-term development programmes (Slack et al., 2013), attracting and integrating individuals into the match officiating community, as well as increasing retention rates (Ridinger et al., 2017). Technology tools, such as video, have also been highlighted to support reflection and discussion processes (Cunningham et al., 2014), which could act to enhance mentoring and support with the inclusion of objective information.

Video itself has been acknowledged as a widely adopted tool within feedback processes, perceived to enhance learning in athletes. Groom et al. (2011) identified how video feedback can help create a mutual understanding between athlete and coach, acting as a teaching tool. McArdle's technology-driven analysis has also been highlighted as a method that can enable a more effective debrief process as a facilitative tool (McArdle et al., 2010). Such tools appear to have a positive role in enhancing development processes yet identifying how and where implementation is valuable may act to further benefit effective implementation of positive development and learning opportunities for match officials.

Whilst value is apparent in the implementation of technology, exploring perceptions towards these processes in sports pursuing modernisation, such as netball (Sam et al., 2018), could act to highlight how governing bodies can look to enhance provision across geographical areas. Consideration towards differences in levels of development is required, which can be impacted by factors such as finance and availability, both of which effect the ability to adopt and utilise technology (Best et al., 2021; Sellitto et al., 2016). Exploring the differences in geographical regions could identify how factors such as sharing resource and mentoring support on digital platforms might improve provision on a wider scale. Furthermore, investigation into the use of video within mentoring and feedback processes is limited, thus assessing the use of tools and

processes involving video could highlight positive features that enhance learning and development. Therefore, the aim of this research was to investigate the role of technology within match official development in netball. Specifically, this research sought to explore: (a) the experiences of umpires and key administrators (e.g. mentors, assessors, coaches) with technology in the development pathways in their nations and regions; (b) the advantages and disadvantages of the technology and associated tools that the participants have access to; and (c) what considerations are required to ensure that learning provision through technology is impactful across development pathways.

Method

Research design

To investigate the aim of this research, a qualitative approach was adopted by employing semi-structured interviews to explore people's thoughts and feelings (Creswell & Creswell, 2017). Capturing both experiences and perspectives of those individuals with a personal stake in the research area, in this instance individuals with first-hand experience of netball match officiating and the development pathways and structures in their nation and region, enabled the production of rich and detailed data (Braun & Clarke, 2013). This approach is a practice that has become an increasingly successful methodological tool in the sports literature (e.g. Webb et al., 2020). Adopting this method assisted in yielding more depth in responses from the participants, permitting a more detailed analysis of the interview transcripts. This stance is compatible with constructionist paradigms, where the findings are a construct of the interaction between the interpreter and interpreted, and where knowledge is constructed rather than discovered (Levers, 2013). In this instance, it allowed the researchers to explore the role of technology

as part of development, support structures and processes in netball match officiating.

Participants

The sample included 28 participants (M_{age} = 45.21, SD = 13.74 years) working in a variety of roles within netball match officiating internationally. These roles included single and mixed umpiring (N = 21), assessing (N = 7), coaching (N = 5), tutoring (N = 5), mentoring (N = 3), administration (N = 3), and bench officiating (N = 1). This is in line with previous research identifying saturation occurring between 21 and 31 interviews (Braun & Clarke, 2021a). To ensure anonymity, and to meet the requirements that were part of the study's ethical approval, the participants were allocated a pseudonym, which are used in the Findings and Discussion section. To gain greater insights into the development of officiating in netball, the participants were sampled using a purposive maximal variation method, which aimed to capture and encompass a wide variety of perspectives (Creswell & Clark, 2018; Marshall, 1996). The participant sample base included individuals working in administration, coaching, mentoring, assessing and tutoring roles, in addition to active umpires currently officiating. The inclusion of such key administrators and stakeholders, created a holistic viewpoint on umpire development and added depth to the data (Webb et al., 2016). Moreover, a more diverse participant sample helped to identify differences between nations, cultures, and levels of netball (Gerhart, 2008; McSweeney, 2002). Participant details are presented in Table 1, specifying the region, pseudonym, age range, role(s) fulfilled, and whether they worked in a part-time or full-time capacity in netball match officiating.

Procedure

Following institutional ethical approval, participants expressing interest were contacted directly using their personal e-mail address, detailing the nature of the study, and asking if they wished to participate. Each participant had expressed interest in the study by leaving their contact details following completion of a World Netball survey of netball match officials as part of a separate research investigation. Once agreement to participate was confirmed, a convenient time for the interview to be conducted was agreed, along with sharing the study information sheet and consent form. The interviews were conducted using the video application Zoom or by telephone, which provided flexibility in scheduling the interview in consideration of geographical location and the participants' daily life (Sparkes & Smith, 2014). As physical interaction was still missing, it was important to ensure the participant felt their views were being recorded accurately (Sparkes & Smith, 2014). The interviews were recorded in a voice recorder, or Zoom and Otter AI, with audio being reviewed in Otter AI post-interview to ensure the accuracy of each interview transcript. Rapport was established to aid with this process, providing the participant with appropriate detail on the project, the interviewer and their role and experience to create an open environment permitting questions to be asked freely (DiCicco-Bloom & Crabtree, 2006). The participants were reminded of their right to withdraw before commencing the interview and that their identify would remain anonymous in any reporting of data.

Data collection

All participants took part in a semi-structured interview conducted either between August and September 2019 or August and October 2021, with one member of the research team conducting each of the interviews. The researchers conducting the interviews had qualitative research and interview training, with members of the research team having extensive experience in conducting interviews.

Table 1. Netball match officials' demographic information.

Region	Pseudonym	Age range	Role(s)	Part-time or full-time
Africa	Harry	25–34	Umpire	Part-time
	Chloe	25–34	Umpire/Mentor/Assessor	Part-time
	Grace	45–54	Umpire	Part-time
	Zoe	35–44	Umpire	Part-time
	Jack	25–34	Umpire	Full-time
Americas	Isabella	65+	Assessor	Part-time
	Felicity	65+	Coach/Assessor	Part-time
	Oscar	45–54	Umpire	Part-time
	Bethany	45–54	Coach/Administrator	Full-time
Asia	Sarah	25–34	Umpire	Part-time
	Emma	65+	Coach/Assessor	Part-time
	George	35–44	Umpire	Part-time
	Katie	45–54	Umpire	Part-time
	Olivia	35–44	Umpire	Part-time
	Heidi	45–54	Coach/Umpire	Part-time
	Lucy	35–44	Umpire/Administrator	Part-time
	Molly	35–44	Umpire	Part-time
Europe	Hannah	65+	Assessor/Tutor/Mentor	Part-time
	Charlotte	45–54	Umpire	Part-time
	Eleanor	35–44	Umpire	Part-time
	Elizabeth	35–44	Administrator	Part-time
	Alice	35–44	Umpire	Part-time
	Sophia	45–54	Umpire/Assessor/Tutor/Mentor	Part-time
	Polly	45–54	Umpire	Part-time
Oceania	Holly	25–34	Umpire	Full-time?
	Emma	25–34	Umpire	Part-time
	Jessica	25–34	Umpire	Part-time
	Harriet	55–64	Coach/Assessor/Bench official	Part-time

The interviews lasted on average 68 minutes 17 seconds. It is important to note that the interviewer was at liberty to move away from the question guide, when a valuable point was made by the participant, adding depth to the details being discussed and elaborate on issues relevant to them (Sparkes & Smith, 2014).

Following the initial exchange to establish rapport between the participant and the interviewer, the first set of questions which were designed to build a profile of the participant. The questions looked to establish the participant's history in netball, what role(s) they had fulfilled, and the nature of the role(s) (e.g. Is this role part or full time? Are any aspects of your work provided on a volunteer basis?), the levels of netball they work at, and if they balance this role(s) with another job or career.

The next section sought detail on support provision, exploring support networks and mentoring that the participant could access (e.g. Please explain and outline any mentoring that you receive or provide?), and the use and impact of feedback and assessment (Do you feel this has a beneficial effect, resulting in improvement?). This was followed by questions regarding development mechanisms, so the adequacy and availability of training, workshops, courses, and information and resources (e.g. Do you feel you have adequate opportunities to develop in your role(s)?), and if technology have been adopted appropriately in providing learning and development opportunities (e.g. What ways could technology be utilised more effectively?).

The final set of questions focused on governing body investment, asking if the participant was aware of the structures domestically and internationally, what level of support they receive from governing bodies (e.g. What information and opportunities are provided by your governing body, your regional federation, and World Netball?), if they felt standardisation of training and development would be beneficial,

and how valued, satisfied and motivated they felt in their role(s). To conclude the interview, participants were invited to share any final points and were thanked for their participation. All interviews were audio-recorded and transcribed verbatim.

Data analysis

The interview data were analysed through thematic analysis (Braun & Clarke, 2019). This method was deemed appropriate for the purposes of this study because this study consists of a specific focus, with technological adoption providing a lens by which to interpret the data (Braun & Clarke, 2022). This approach enabled the perspectives of the participant to be identified in relation to the role of technology within development and support structures and the reasons behind these views. The analysis was conducted by one member of the research team, with the resulting themes being shared amongst the research team to review and discuss.

The analysis was conducted with reference to the six-phase approach of Braun and Clarke (2021b). Firstly, familiarisation with the data was achieved by reading the interview transcripts several times. Next, initial inductive coding was conducted by one member of the research team to create labels of key features and to highlight and describe the content within the transcripts. The inductive coding was framed under the umbrella topic of technology in match official development, reflecting a process detailed in previous research (Boyatzis, 1998; Fereday & Muir-Cochrane, 2006). The process here assisted in creating a hybrid scenario; whilst the research was focused in a deductive manner on the role of technology, the analysis itself was inductive, by which the data drove the approach. Patterns were then identified, enabling the creation of initial themes, which were consequently reviewed to ensure that the data were being represented correctly. The proposed themes

were then reviewed to ensure they were appropriate in relation to the data set. The review process was completed by two members of the research team, to enable the generation of themes. Themes were then finalised and named to best ensure accurate reflection of the data in that theme. Finally, the writing of the findings and production of a report was performed. The finalised themes are presented in Figure 1, and through the Findings and Discussion section, direct quotes are provided to aid understanding.

Trustworthiness

The quality and rigour of this research were assured through several steps. The population sample was the initial step, with participants holding a variety of first-hand experiences and insight into the research question. This has been presented and explained through the methodology. The truth in the findings of this research is also crucial to enhancing trustworthiness, aiming for credibility, transferability, dependability, and confirmability (Guba & Lincoln, 1994). Therefore, a member-checking process was adopted, where each participant was invited to evaluate their interview transcript for accuracy and authenticity of its content (Birt et al., 2016). Four participants commented on or adjusted their transcripts, with amendments made to names of people or places and clarification or explanation of certain statements. The findings from the analysis were compiled and disseminated with World Netball, who were at liberty to share the findings with the wider netball community.

Findings and discussion

The aim of this research was to explore the role of technology in development pathways available to netball officials. From the analysis, three higher order themes were generated, which highlight how technology has been adopted to impact such pathways: (i)
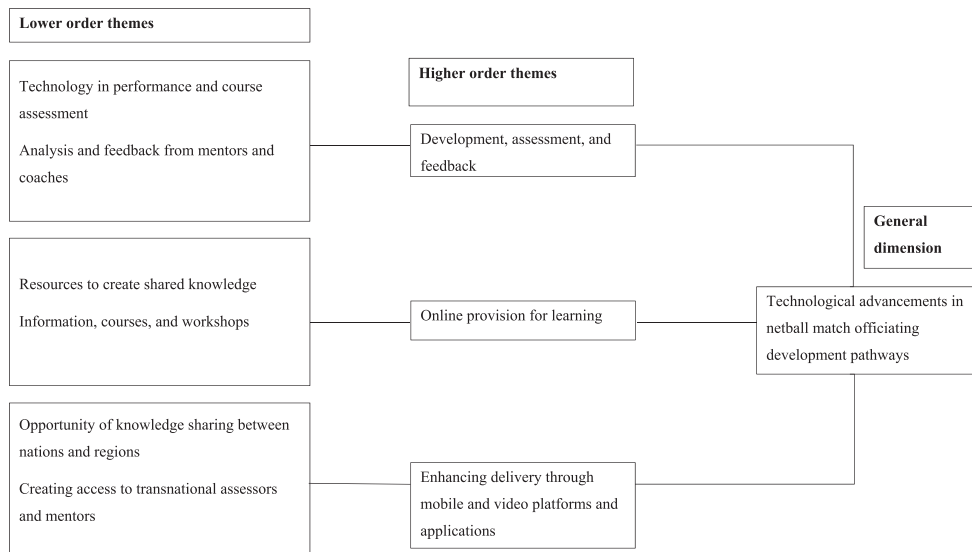
Figure 1. Higher and lower order themes from the analysis of the interview transcript data.

development, assessment, and feedback; (ii) online provision for learning; and (iii) enhancing delivery through mobile and video platforms and applications. The discussion of these results focuses on the lower order themes, each of which are presented individually, with direct quotes from participants to illustrate their meaning.

Development, assessment, and feedback

This theme discusses the role that technology plays within assessment of performance, with the data highlighting impacts on performance assessment processes, how platforms can be adopted to enhance course assessment and how these assessments are conducted. Additionally, the impact of technology on feedback provided by mentors and assessors is discussed, specifically the adoption of video analysis and feedback.

Technology in performance and course assessment

Match officiating requires significant declarative knowledge, or knowing "about" something, with reference to the laws of the game and

when they should be applied (MacMahon et al., 2007). An apparent challenge appears to be that effective assessment methods are required to test this knowledge. Olivia (umpire, Asia) highlighted whether online examination was a true indication of knowledge and understanding, "I think the new online theory they've got; you technically could just be looking at the website and then answering your questions based on the website". Further to this, as stressed by Hannah (assessor/tutor/mentor, Europe), "There are some umpires who know all the rules back to front but can't actually do it when they're on the side of the court", the need for assessment that provides an indication of procedural knowledge, knowing "how" to do something (Elferink-Gemser et al., 2010), is also required.

Officiating, by nature, is a very practical activity and therefore the incorporation of video in the course assessment process could provide more match-related or contextual experiences for officials (Russell et al., 2022), and in time, further developing the assessment process. This was highlighted by Jack (umpire, Africa), who felt that online platforms should

be part of the course assessment process to facilitate instructor support remotely;

> … there should be an online way of doing it, critical or practical assessment for umpiring. You should be able to have a system online, we fill the papers, then we send our videos, then that should reduce the amount of time instructors teach us when they are there physically.

However, issues were identified with this process regarding the accuracy and the legitimacy of online assessments. For example, Emily (umpire, Oceania) discussed her own experiences with online examinations, "I actually found mistakes in the exam, to the point where I put down about three answers". It is recognised that this is a difficult balance to strike, particularly for online assessments, but these points highlight the positive impact technology could have on a variety of learning and development processes, acting to open-up the accessible and practical nature of online platforms to a wider audience (Vinson et al., 2017).

Feedback during match performance was also raised as a beneficial practice, where the provision of video feedback could add value to the assessment process;

> … at an international tournament there should be an assessing panel and there should be a coaching panel so the assessing panel [critiques] you but there should be a coaching panel that actually sits there all day with videos, and you can walk in and say, "I want to look at quarter 4 of my game. Would you mind?" (Grace - umpire, Africa).

The provision of such feedback may enable learning opportunities to occur during performance (Francis & Jones, 2014), which could be easier to implement to identify an immediate change (Mason et al., 2020). As such, video supplementing the feedback provided by mentors or coaches could potentially enhance understanding developed by a match official (Mascarenhas et al., 2005). However, previous research in netball identified that interval feedback during performance can potentially detract from normal information processing that umpires conduct during match performance (Mahoney et al., 2008). As such, whilst feedback might provide some benefits in learning and development, caution is required in assuming that these benefits occur exclusively and further assessment on the effects of feedback are required.

Analysis and feedback from mentors and coaches

The inclusion of video in the provision of augmented feedback has been utilised to promote learning opportunities and reflection (Groom et al., 2011). In officiating, Katie (umpire, Asia) explained how video analysis (VA) in particular has been adopted;

> VA can be a really useful tool. It's become quite a focus in terms of what we're required to do in our self-analysis and our sort of performance reporting and things, so I do think that VA does help you to refine your read of the game.

The addition of video was also believed to benefit the feedback process, with Hannah (assessor/tutor/mentor, Europe) stating, "It's about everything that's got to be evidence based, and you're giving feedback to an umpire and even more so nowadays, because the umpire can go and check it on the video, so you can't get away with anything". Game footage to evaluate procedural knowledge when assessors are not accessible could act as a positive application in the assessment process. However, reducing threats and pressures within the feedback environment are crucial considerations to enhance learning (Gleeson & Kelly, 2021).

Receiving regular feedback on performance from coaches and mentors to develop performance is of importance to officials, something which has been enhanced through the provision of video (Webb et al., 2016). This has

important implications in terms of providing further opportunities for individuals to learn;

> A quarter of a video would give you a lot of feedback in terms of your effective use of your own voice, your use of your whistle, your position, because then you can actually say, "well, hold on, that's what my assessor was telling you" (Alice - umpire, Europe).

This highlights the impactful role that video can have in feedback, something that has been reported to enhance learning and accelerate skill acquisition by providing information on what movement patterns are required to perform successfully (Hodges et al., 2003).

The positive nature of combining feedback with video was highlighted by Sophia (umpire/assessor/tutor/mentor, Europe), " … I might get a few videos sent to me to say these guys were on your course, can you have a look? Can you give feedback to them? So, it's keeping that contact going … ". However, Harriet (coach/assessor/bench official, Oceania) believed that video feedback is only of benefit when in the presence of a mentor or coach, " … while technology is good and you can watch some videos, you still need to be able to have somebody beside you as well". Despite technology affording opportunities to expand how learning can occur, the effect may not be due to the technology alone, thus pedagogical approaches from mentors or coaches are critical considerations in this arrangement in both online and face-to-face environments (Cushion & Townsend, 2018).

Online provision for learning

This theme highlights the influence solutions created by technology have in enabling further learning and development opportunities, permitting knowledge sharing across regions. This is further exemplified by how courses and workshops, in addition to the dissemination of information, are broadened through mobile and video applications.

Resources to create shared knowledge

Technology could enable the development of resources driven to create mutual understanding. This concept was discussed by Charlotte (umpire, Europe), who identified the need to create learning opportunities through exposure to different levels of netball, "The number one problem that some of the different nations around the world have and actually say [is] they cannot access the level of game. Now, the first way to access that level is to watch it". It is important to note that transition from declarative to procedural knowledge has been reported as being facilitated more effectively by performing an activity, rather than through observation alone (Williams & Davids, 1995). Yet, it is imperative for information to be accessible across broader geographical areas to ensure learning and development is constant (Joshi et al., 2009), something which is evidently not occurring as a matter of course.

Wider learning opportunities were highlighted as a particular benefit in regions where additional resource is required to supplement existing development structures and pathways. Countries such as England, Australia and New Zealand have greater financial resources when it comes to the development of their officials, and so could provide more training opportunities. For example, Harry (umpire, Africa) identified, " … they've got lots of videos [on their websites regarding rule interpretation] that are really helpful, especially umpire development. You can now take your browser and try to type in Netball Africa. There is no website for Netball Africa". The benefits of being able to access supplementary learning material was further acknowledged by Chloe (umpire/mentor/assessor, Africa), who discussed perceived advantages of being able to access platforms created through technological advancement and development, " … 20 years ago, I couldn't watch videos and learn,

they [umpires] had to actually be there to learn and that obviously takes longer. Now I can sit every night and watch videos or watch YouTube". These points emphasise that learning designs should be accessible in their approach (Darling-Hammond et al., 2020), with the aim of creating impact within the audience that is receiving such information. Any widening of access to resources could act to enhance impact across geographical regions through widely accessible platforms.

The implementation of technological solutions has been reported to impact positively on workforce experiences by enhancing organisational capabilities (Smoyer et al., 2021), yet Harriet (coach/assessor/bench official, Oceania) reported that resources might not be relevant to development needs, "there is unlimited stuff on resources on the New Zealand website, but I don't know if it's actually specific to what an umpire would require". In contrast with Harry, this identifies potential generational differences that need to be overcome to ensure comfort with using modernised development processes (Adams, 2011). The use of and the education/training provided on any platform must be viewed as relevant for all officials. Internal provision might play an important role in engaging an audience, and the application of technologies should aim to allow organisations to evaluate their actions to ensure impact (Houlihan & Green, 2009). Holly (umpire, Oceania) highlighted, "Great information at the start, constant emails, next year, great information at the start, squad stuff, got all that, and then like kind of, dead, dead silence. Just as a general whole, Netball New Zealand haven't been very forthcoming". It is imperative that provision is monitored effectively to enhance development and learning opportunities, particularly when such provision is demanded to ensure that development structures continue to improve officials (Cunningham et al., 2022).

Information, courses, and workshops

Communication platforms and systems can have a positive impact in providing information effectively for officials without time constraints (Ferkins & Shilbury, 2015), particularly as communication is occurring more instantly in society (Ratten, 2020), potentially producing ongoing information regarding learning opportunities for a significant number of officials. Sarah (umpire, Asia) discussed her experiences with these applications, "We use TeamApp [smartphone communication app] quite a fair bit and they'll advertise on that, like a new notification pop up like this is available, and it'll have in there recommended for C badges". Similar positive practice was also highlighted when using social media. Elizabeth (administrator, Europe) stated how sharing information from a regional organisation internally could help to advertise development opportunities, "The Netball Europe courses, they were advertised to our secretary and we just sort of advertised within our organisation, you know put them on Facebook and I contact the people and stuff". The adoption of mobile and video platforms and applications in courses and workshops might also be of benefit. Olivia (umpire, Asia) felt engagement in development processes could be enhanced because of technological adoption, "I think you'll get a high level of engagement because people can't travel so people are more likely to jump online versus coming into a face-to-face meeting, these days anyway". This highlights the positive role of providing adequate educational solutions that enhance engagement (Samuel et al., 2022), identifying benefits with online provision when compared to face-to-face training. Research shows that increasing opportunities through online training is a positive development experience for officials, which can create support networks that can be used to resolve specific issues (Webb et al., 2019; Webb et al., 2021). Provision in this manner could act to further enhance the training and

support processes that officials are able to access as they progress through their respective pathways.

There were, however, opinions that were less favourable towards online delivery, particularly regarding whether education provided through online platforms is the most effective method to promote learning. Emma (coach/assessor, Asia) was unsure what impact online learning platforms offer;

> I think the first thing I've seen from [Netball] Australia in nearly two years is they're launching some new learning platform. Well, whoopy do. It's going to cost them a squillion dollars and what's it going to do for my people? Sweet bugger all. Online learning can only go so far.

Despite online provision potentially creating wider outreach and engagement in different communities, dependent on availability across regions, this point questions what return there is from investing in technological solutions and whether there is a real need for it if the impact is only apparent at a specific level of official e.g. more qualified (Best et al., 2021). Furthermore, perceptions towards using such technology might also create reservations, for example, the time involved in creating learning material and competence in using such platforms (Palao et al., 2015). Ensuring that the benefits of adopting tools of this kind are driven from a global governing body perspective might allow effective implementation to overcome disfavour and potential socio-cultural differences between younger and older group members (Sam et al., 2018).

Enhancing delivery through mobile and video platforms and applications

This theme highlights how online settings create a wider distribution of knowledge, particularly from more developed nations. The impact of platforms in enabling broader mentor and assessor access is also discussed,

creating support networks and processes perceived as crucial to match official development.

Opportunity of knowledge sharing between nations and regions

The idea of sharing knowledge across communities is an area that technology could assist positively, particularly when strategies could be developed to support local, regional, and global levels (Pan & Leidner, 2003). For example, Polly (umpire, Europe) identified that feedback and assessment processes could benefit from online delivery from a logistics and accessibility perspective,

> … you could do a lot of VA and a lot of stuff by online sessions … You could get the New Zealand person in the same room at the same time [as others in other countries], that's something that's also I think, absolutely crucial.

This highlights the positive role that sharing experiences can have (Lucas et al., 2021), which would benefit development in the wider officiating community by creating greater access, aligning different officiating groups across regions and increasing the number of programmes and therefore the participants involved (Sam et al., 2018).

However, the source of such information, or who coordinates the sharing of knowledge to impact a wider community requires consideration, with information at a regional level not always available. Therefore, wider coordination of the provision that is available in such online settings would be required from a wider global perspective, something Heidi (coach/umpire, Asia) explained;

> I think if we could get from countries where they have so much more depth in umpiring like the UK, like Australia, where you have a bit more exchange between how they see things and how they standardise their things, I think it would be very helpful.

There is an apparent need for effective application of knowledge sharing across a multilevel

perspective and committing to inclusivity across communities (Ratten, 2020). Governing bodies could influence and stimulate the sharing and creation of knowledge, particularly through online platforms (Willem et al., 2019), yet that transfer of knowledge might be a critical factor to its effectiveness, particularly when considering differing stages of development across nations (Schenk et al., 2015). As such, creating opportunities to experience effective practice on a broader scale, such as support from mentors (Cunningham et al., 2014), could allow enhanced learning and development to occur.

Creating access to transnational assessors and mentors

The benefits of the adoption of technology solutions as part of the mentoring process have been reported previously (Livingston et al., 2017), and might play an important role, particularly in areas that could lack local or regional support. Grace (umpire, Africa) identified the importance of mentors to help develop expertise,

> When I listen to the Australians, and the level of netball and the level of expertise and coaching and the resources that they have available, I have nothing like that, and I don't have a mentor even close to me.

Consideration needs to be given towards ensuring that appropriate support structures are provided irrespective of geographical or structural constraints and resources available between nations and their respective federations. Isabella (assessor, Americas) reported her experiences of supporting umpires outside of her region;

> I worked in Hudl [video analysis platform]. They asked me to work and assess some umpires in their Vitality series [United Kingdom] and I thought that was very helpful and so I think it's a good tool that other countries can have.

This suggests how invaluable mentoring is at the elite level and that it should be a key part

of development programmes (Slack et al., 2013), yet such support is also of great benefit to officials through all levels of any development pathway (Cleland et al., 2018). Mentoring programmes could act positively in helping to retain officials and support them through their respective pathways, including the provision of appropriate educational material which enhances the environment in which officials perform (Webb et al., 2020).

Enabling the sharing of performance information, such as video, to enhance the mentoring process was an aspect that was raised by respondents. Zoe (umpire, Africa) shared her positive experiences when receiving mentoring from overseas, "I send stuff to them and say have a look and see what you can see, what I can change or do better or stuff like that as well, so I try to use as much [of the] UAPs that I can". Whilst such positive processes seemingly benefit officials, there is a need for administrations to ensure that adequate support is provided (Forbes & Livingston, 2013), the application of which should be considered in relation to factors such as cost, required skills, and the compatibility of any provision (Sellitto et al., 2016), ensuring that the support meets the requirements of those asking for it.

Creating processes that can enhance such support would be beneficial to the development opportunities that officials have access to, particularly when considering that mentoring is a key part in the retention of officials (Ridinger et al., 2017). Effective support structures may assist development of a positive community environment within officiating (Loghmani et al., 2021), which in turn would enable more effective progression through development pathways (Webb et al., 2021). However, the adoption of technology products within this process might be constrained in terms of availability and financial implications (Best et al., 2021). Therefore, it is important to consider the best methods of implementing technology, ensuring that the accessibility and provision provides development processes

that are effective through all levels and pathways.

Conclusion

This research has explored technology within global match official development processes in netball and views on the benefits and importance of associated tools and platforms. A variety of uses are apparent, with enhancements in assessment and feedback processes evident in partnership with video. Provision of online learning opportunities, through the sharing of resources to enhance knowledge and wider course and workshop availability were viewed positively, especially within regions that lacked the more evolved development structures, but generational differences might be apparent. Adopting platforms and applications to broaden knowledge sharing across regions and opening mentor and assessor opportunities were also reported as useful development mechanisms, permitting increased global development to occur.

The findings presented in this research have important implications with regards to policy and practice. This research has explored technology access and application across the five netball regions (Africa, Americas, Asia, Europe, Oceania), and there is adoption of technology on a wide geographical scale, yet the level of provision varies from region to region. As such, it is vital to consider these implications with governing bodies and officiating organisations in all regions to assist with development, irrespective of any geographical location, where technology could remove time constraints by enabling asynchronous usage. It must be noted that consideration of cost and availability is required, in such a way that governing bodies ensure that the promotion of or investment in technology tools and platforms are feasible for all concerned, and that governing bodies are therefore implementing policy that supports equal opportunities. The responsibility of implementation might fall to regional

bodies, who vary in terms of wealth, even in comparison to the global governing body. However, the following matters are proposed as areas of focus in which technology could impact development processes:

(1) Video was identified to enhance assessment processes and feedback from mentors by creating augmented information, yet it is important to ensure that video is used effectively in such processes, enabling learning to occur.
   (a) Establishing methods to assess the effect of video feedback on learning and transfer into performance is essential.
   (b) Creating understanding of how to effectively use video in feedback could also help to ensure that those providing feedback (e.g. mentors) are doing so in a manner conducive to the promotion of learning. This could be through training at a local level.
(2) The provision of accessible platforms to access knowledge through proactive investment from governing bodies should ensure that information is appropriate for all.
   (a) Implementation of online learning and development opportunities, produced across national, regional, and global authorities.
   (b) Users develop an understanding at national levels to create effective use.
(3) Any widening of resources would also benefit from greater knowledge-sharing processes.
   (a) Aligned development across regions through global coordination.
   (b) Aim to generate increased participation across regions in such opportunities and potentially expand the numbers of match officials.
(4) The creation of educational material and support from mentors across geographical areas.

(a) Creation of positive environments at a national level with availability of support fostered through technology.

(b) Investment at regional levels to enrich development experience across nations.

There are some limitations with regards to this research. Firstly, as far as the authors are aware, this is the first international study to focus on netball, thus further research is required in the sport to examine the role of technology plays in development pathways of sport officials further. The data are limited to what could be generated from interview responses, where the interview guide was not solely focused on uses of and perceptions towards technology, and future research could employ surveys or questionnaires to increase the number of responses from different regions around the world. Whilst it is a strength of this research that participants were from nations of varying netball development status, greater comparison, and contrast between developing or emerging nations is required to discuss the needs in nations and regions in terms of officiating resource and financial investment. With avenues to pursue, building the implementation and accessibility to technology solutions could act to positively impact the learning and development opportunities that netball match officials can access. These implementations could also consider the impact on officials from a significant geographical scale, perhaps helping to create greater equity in development pathways across regions, and in turn impacting on the appeal of match officiating, supporting the further growth of netball as a sport.

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