Expert in My Pocket: Creating First Person POV Videos to Enhance Mobile Learning

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Worldwide, there has been a rapid increase in both the use of mobile technologies as a conduit for student learning and the use of wearable cameras to record sporting and recreational activities. The Expert in My Pocket project (EiMP) has combined these two technologies to produce a repository of freely available short videos and supporting materials to enhance student development of psychomotor clinical skills. The videos are presented from a first person point of view (1PPOV) with expert health professionals 'thinking aloud' as they demonstrate selected skills. Research indicates that students and educators overwhelmingly support the concept of EiMP videos and more importantly value the 1PPOV as an authentic view. This paper demonstrates the techniques and equipment employed to produce these videos, which consisted of a chest or head mounted GoPro camera operated via an iPad. Additionally, the paper explains another innovative feature, Quick Response (QR) Codes, that when linked to the videos placed on equipment assists with "just in time" mobile learning.

Introduction

Nursing and paramedic students require extensive preparation and training to attain competency in clinical skills (Cardoso et al., 2012; Hibbert et al., 2013; Lynch, Barr, & Oprescu, 2012). Ensuring adequate competency prior to students being introduced to the clinical setting may improve patient safety (Cardoso et al., 2012; Lau, Chuk, & Wei So, 2002) and health outcomes (Hibbert et al., 2013; Levett-Jones, Gersbach, Arthur, & Roche, 2011). Teaching strategies for efficient clinical skill acquisition should allow students to experience situations similar to clinical settings (Blum, Borglund, & Parcells, 2010; Cardoso et al., 2012; M. M. Hansen, 2011) in order to gain a deep understanding of context dependent concepts (Lynch et al., 2012). A learner-centred approach focused on knowledge conversion to experience through repetition and expert guidance in a supportive environment is acknowledged as an effective teaching strategy for clinical skills (Cosman, 2013; Joy & Nickless, 2008; Lee, Boyd, & Stuart, 2007). However, the teaching of clinical skills in a tertiary environment can be impacted by growing student numbers (M. M. Hansen, 2011; Holland et al., 2013; Kelly, Lyng, McGrath, & Cannon, 2009) and restricted access to expert performance (M. M. Hansen, 2011; Holland et al., 2013; Kelly et al., 2009). Information and communications technology (ICT) can provide some solutions to this challenge (Arguel & Jamet, 2009).

Tertiary institutions increasingly use ICT based solutions for health education delivery (Arguel & Jamet, 2009). ICT based solutions are documented as appealing to many students who are familiar with technology use from a young age (Duncan, Yarwood-Ross, & Haigh, 2013; Kelly et al., 2009). Students may even actively demand adoption of interactive and self-directed learning elements in health curricula (Chan, 2010; Duncan et al., 2013; Kelly et al., 2009). In line with this, there appears to be an increasing shift towards online (Duncan et al., 2013), mobile (M. M. Hansen, 2011; Pimmer, Linxen, Gröhbiel, Jha, & Burg, 2012) and handheld technology (Koeniger-Donohue, 2008) use in healthcare education. This shift towards blended learning methods (Chan, 2010) may improve knowledge, skill and performance of students in health sciences. While utilising videos for teaching and learning clinical skills in paramedic and nursing sciences is an emerging field of research (Chan, 2010; Hibbert et al., 2013), literature on acquisition of clinical skills by students in health disciplines utilising ICT solutions is scarce (Hibbert et al., 2013).

Videos can be used to support various student learning styles (Chan, 2010; Duncan et al., 2013; Roshier, Foster, & Jones, 2011). Some students appreciate the familiarity of videos from the computer game environment and benefit from video learning resources that provide a socially supported setting that is safe to participate in (Chan, 2010; Kelly et al., 2009). Students regularly access videos using mobile multimedia technologies for private use (Hibbert et al., 2013; Pimmer et al., 2012). It has been demonstrated that students who have access to videos following initial clinical skill training maintain higher levels of competence (M. Hansen et al., 2011), value the use of multimedia and the ability to download videos on demand (Everett & Wright, 2012). By using technology to support pedagogically sound learning activities, students may be able to faster acquire and master specialised information (Duke, Harper, & Johnston, 2013). Provided high quality downloadable educational content is available (M. M. Hansen, 2011; Roshier et al., 2011), mobile learning using videos could be a valuable resource for teaching and learning in health related educational programs.

Experiential learning

Educational theory supports video use for clinical skill acquisition (Holland et al., 2013). Literature confirms videos as an equal or more effective teaching method for advanced clinical skills compared to traditional face-to-face instructions in terms of skill acquisition (Cardoso et al., 2012; M. M. Hansen, 2011; Hibbert et al., 2013; Holland et al., 2013; Kelly et al., 2009). The student-centred experiential learning approach recognises the complementary role of technology and pedagogy in education, advocating for a technology-rich learning experience (Lynch et al., 2012). Videos address the observation element of the four step cyclical learning process of Kolb's experiential learning theory (Kolb, 1984). Furthermore, video use is underpinned by self-regulated learning theory (Brydges, Carnahan, Safir, & Dubrowski, 2009), providing students with "access to information resources upon which processes of construction must draw" (Butler & Winne, 1995, p.275). Forming connections between nodes of learning, videos, face to face, texts, is intrinsic to developing clinical competencies in the modern pedagogy (Lau et al., 2002; Siemens, 2005).

Documented advantages of video usage

High quality videos can be used as educational resources with multiple benefits for teaching and learning clinical skills including: greater capacity to link theory and practice, potential to stimulate deep learning, engagement and critical reflection (Lau et al., 2002; Lynch et al., 2012; Roshier et al., 2011). Students may prefer video instructions due to greater flexibility, the opportunity to self-manage and to engage in learning on several occasions over time (Kelly et al., 2009). Repetitive viewing allows pause and replay of content as needed which assists student understanding and improves information retention (Whatley & Ahmad, 2007). Video use not only allows students to learn at their own pace, own time and in the comfort of their own environments, but could also encourage independent learning. This enables increased autonomy and sense of control over the learning process (Kelly et al., 2009). For example, students can be more efficient, refer to videos for aspects they have questions about and use videos as a visual reference (Mehrpour, Aghamirsalim, Motamedi, Ardeshir Larijani, & Sorbi, 2013). In this regard videos are useful for viewing correct skill performance techniques, observing interactions with real patients, and detecting differences between normal and abnormal clinical signs (Hibbert et al., 2013). Other documented advantages of using videos for teaching clinical skills include supporting students to construct knowledge interactively and reality depiction under controlled conditions (Cardoso et al., 2012).

Research suggests use of videos as a practical teaching method with low production costs, wide reach, high information quality and variety of use options within a group or individually (Cardoso et al., 2012). This technique allows students to be introduced to the clinical setting in a safe manner that is conducive to reducing stress and enhancing quality of care (Cardoso et al., 2012). When downloaded to mobile devices, video instructions can provide an especially useful portable, 'just-in-time' learning resource (Hibbert et al., 2013).

Project background

Despite established advantages of using videos for learning of clinical skills, prior to the video resources produced by the Expert in My Pocket project, literature review and expert consultations concluded that no standardised evidence-based video resources existed for teaching paramedic or nursing clinical skills across Australia. Concurrently, feedback from educators and students alike evidenced a lack of common understanding about how to perform and teach specific clinical skills. (EIMP, 2015) A pilot project conducted at the University of the Sunshine Coast (USC) on teaching clinical skills using short videos filmed from a 1PPOV established the student satisfaction and demand for standardised, online skill-specific video resources that students could consult 'just in time' such as before exams or training in clinical settings (Lynch, Downer & Hitchen-Holmes 2010; Lynch, Barr & Oprescu 2012). The EiMP project refined the concept and video production processes of this pilot to effectively address student demand and existing knowledge gaps in clinical skills education.

The project was undertaken in collaboration with a project team of nine, with members from the University of the Sunshine Coast (USC) and Deakin University. During the period of July 2013 to November 2014, the project created a free, publicly accessible, standardised repository (website) of learning resources comprising videos and supporting materials to enhance student development of psychomotor clinical skills.

The following 30 short instructional videos were created from a first person point of view (1PPOV) with expert health professionals narrating their actions during skill demonstrations:

a) Resuscitation skills (Defibrillation, Oropharyngeal Airway, Bag Mask Ventilation, Laryngeal Mask Airway, Nasopharyngeal Airway, Oropharyngeal Suction, CPR and Defibrillation, Triple Airway Manoeuvre).
b) Procedures (Continuous Cardiac Monitoring, Neurological Observations, Twelve-Lead ECG, Blood Glucose Level Measurement, Oxygen Administration, Oxygen Saturation, Cervical Spine Immobilisation, Chest Auscultation).
c) Medication (Injection Preparation, Intramuscular Injection, Subcutaneous Injection, Oral Medication, Sublingual Medication, Intravenous Injection, Peripheral Venous Cannulation).
d) Infection control (Personal Protective Equipment, Hand Disinfection, Wound Care using Aseptic Technique).
e) Vital signs (Pulse Rate, Respiration Rate, Blood Pressure, Tympanic Temperature, Vital Signs - all).

The videos were produced in high-quality format and linked by innovative Quick Response (QR) codes to mobile devices such as smartphones and tablets (EIMP, 2015). Supplementary electronic materials, teaching guides and skill sheets, were also created to complement video resources with the view to provide flexibility and choice for teaching and learning (EIMP, 2015; McAllister et al., 2013).

Expert educators were consulted on two occasions to ensure clinical skill performance on videos was evidence based and specific to the Australian practice setting. Expert opinion identified the produced videos suitable to support: student development of critical inquiry and context awareness, 'just-in-time' and co-operative learning, pre-class preparation and in-class feedback, integration with assessments, and as a resource for 'remediation (EIMP, 2015).

The nursing and paramedic students' satisfaction with the learning resources was surveyed at two time points during the duration of the project with an additional series of focus group interviews conducted for qualitative feedback at both universities. Student feedback obtained confirmed a clear positive response regarding the content, availability, and usefulness of the videos and project resources (EIMP, 2015).

Research aim and questions

The purpose of this paper is to offer health educators guidelines and best practices for creating digital video resources. This paper will demonstrate the equipment and techniques used by the "Expert in My Pocket" project team to produce short instructional clinical skills videos in first person point of view and demonstrate how QR codes of the videos placed on equipment assist with "just in time" learning. The paper will present an overview of challenges faced and describe how these were overcome in the various video production stages. The goal is to inspire health educators to envision how to convert images and sound to create educational videos in their discipline in order to promote understanding of how to produce meaningful video learning resources for students and increase confidence with using these new technologies (Brown, 1985).

The following research questions guided this paper:
* What equipment, techniques and skills are required to produce short instructional clinical skills videos?
* To what extent was it technically challenging to produce short instructional clinical skills videos and what was required for the project team to overcome these challenges?

Research design

Eight semi-structured telephone (two) and face-to-face (six) individual interviews of 20-50 minutes duration were conducted with EiMP project team members during January 2015 to identify video production considerations and learnings relevant to producing instructional clinical skills videos using 1PPOV. Ethics approval was granted by the USC Human Research Ethics Committee (A/13/511) and the Deakin University Human Research Ethics Committee (2013-309). The sample included four females and four males. Six participants were from the USC team, and two interviewees from the Deakin University project team. The participant pool encompassed both the project leader and co-leader, project manager, project officer and four project team members including the video editor. The interviews were conducted and transcribed by a research assistant. A thematic method was used for qualitative data analysis of the interview transcripts. Responses were coded and data extracted relevant to derived themes specifically associated with video recording and production equipment, uploading to YouTube and generation of QR codes. The following is a synthesis of results from this study.

How videos were produced

Video production was divided between the two partner universities with paramedic videos filmed at USC and nursing videos at Deakin. Frequent communication with over 2,000 exchanged emails throughout the duration of the project enabled to standardise the filming and editing procedures. Team members arranged to produce videos with the same or comparable quality, firstly agreeing upon video quality standards. Notes on video production were compared throughout the filming and editing stages regarding visual and audio qualities and specifications (EIMP, 2015). Actors signed consent and release forms to use the videos in the public domain.

Perspective: First Person Point of View

The video production in this project, including technological equipment and camera selection, were prompted by the innovative perspective of recording the clinical skills videos from the first person point of view (1PPOV).

First person POV is closely associated with the term “wearable technology,” the development of which has recently gained momentum through increased availability of portable digital camera technology utilised for recording sporting and recreational activities (Chalfen, 2014; Skiba, 2014). Wearable technology is frequently used to record events from the first person viewpoint. Often the camera is mounted on a performer who participates in dangerous or difficult to perform activities that enable the viewers to experience what the camera user sees (Chalfen, 2014). Wearable technology is a conduit for the provision of first person point of view that aims to closely connect the viewer with the performer via a realistic and authentic perspective that would not be available using the third person point of view (Lynch et al., 2012; McAllister et al., 2013). The wearable technologies can monitor and record surroundings in a way that is convenient and closely connected to the users’ daily needs and activities (Johnson et al., 2013).

Term “wearable technology” encompasses a range of formats from physical activity monitors (smart watches, step counters, heart rate monitors) to multifunctional Google Glass glasses that enable the wearer to retrieve information about their immediate environment in real time (Johnson et al., 2013; Sapargaliyev, 2015; Skiba, 2014). The potential of wearable technologies to impact higher education is considered significant with vast number of promising applications (Johnson et al., 2013; Sapargaliyev, 2015).

Relevant to the teaching of clinical skills, wearable cameras using 1PPOV can convey to students the experience of performing a skill through the eyes of the practitioner, effectively showing what it would be like to perform the skill themselves (Lynch et al., 2012). The first person point of view is conducive to learning through the provision of an experiential and close-to-real-life learning experience that is communicated to the student in a safe and controlled simulation environment (Lynch et al., 2012; Lynch, Downer, & Hitchen-Holmes, 2010; McAllister et al., 2013).

Project survey results indicate that students and educators alike are highly supportive of the Expert in My Pocket videos filmed based on the first person perspective concept. For example, 97% (n=35) of respondents who evaluated the bag-mask ventilation video agreed or strongly agreed with the statement "This video is a useful resource to support student learning, and 92% (n=33) agreed or strongly agreed with the statement "I would recommend this video to other educators or students" (EIMP, 2015). Other research demonstrated a desire for opportunities to see clinical skills performed in a variety of patient care scenarios, including the close up views and for the option to hear the audio narrative that walks the students stepwise through the skill performance process linking rationale and action (McAllister et al., 2013). These videos are perceived to support the development of critical reflection skills for students. The students feel more confident and better prepared for attending classes and entering clinical settings alike. (EIMP, 2015)

Camera and equipment

The EiMP videos were recorded using the chest or head mounted GoPro Hero3+ Black Edition camera that is also considered a generic model camcorder utilised for capturing extreme sports (Chalfen, 2014). The GoPro was selected as the choice of camera for its capabilities to combine high quality with relatively mobile use that is inherently embedded into the use of 1PPOV. Affordability also played a role in choosing the camera. Central concern for matching the camera with the required video format was to ensure functionality: videos were to be captured in a format that could be used for recording performance of clinical skills from the first person point of view, suitable for video editing and later for uploading into YouTube.

The HD quality standard of 1080 (1,920 x 1,080) was used for video recording to ensure optimal quality standards. The GoPro camera medium view setting was predominantly used as it was discovered to best communicate the activities within the setting with ability to focus concurrently on patient and skill performance and to avoid an overload of extraneous information within the scene.

The GoPro was operated via a wirelessly connected iPad with GoPro app for the director to preview and control the camera. An iPad was used to connect to the GoPro to adjust settings, preview footage and start/stop recording. Team members also used individual mobile phones with installed GoPro apps to monitor recording processes.

Video production

The video recordings commenced in various simulation laboratory settings where nursing and paramedic clinical skills were performed on team members, actors and, in the case of invasive procedures, on mannequins. Human patients were chosen for videos to ensure the learners an authentic experience (Lynch et al., 2012; Lynch et al., 2010). The five individuals performing the skills were educators from among team members with extensive practical experience in performing their respective skills. To leave hands free for skill performance, the skill presenters used chest and head harnesses to wear the GoPro camera during filming. The choice of harness was based on the optimal way to capture the skill being demonstrated. The best view and camera angle were often chosen using the trial and error method.

However, unlike the nursing skills that were performed with relatively little movement on behalf of the skills performer, additional equipment had to be used to stabilise the camera when filming of the paramedic skills videos. In these videos, the learner needed to be able to follow movement to capture what was happening concurrently with the patient and on the monitor (i.e. in the case of filming of the continuous cardiac monitoring skill). At times it was necessary to stabilise the swift camera movement from patient to the monitor by placing a neck brace on the skill presenter. Individual skills captured on videos were of varied complexity levels and it took on average several recording attempts to result in a video clip being deemed successful by project members. The videos with an average final edited length of 1-2 minutes took between around ten minutes (i.e. the laryngeal mask airway video) to five hours (twelve-lead ECG video) to shoot.

> "I think we did our 12-lead video and it took hours. It took probably five hours to get the video, because of those issues of we were trying to go from someone's toes to chest and off to a monitor on the side – there was just so much movement. And that skill to

complete…you know, when I do that in that sort of setting it takes five-six minutes at least. And you are trying to compress that into 90 seconds. And make it look smooth," one team member advised.

For time saving purposes during filming and for accuracy, the skill presenters researched literature and consulted experts to ensure evidence-based skill performance in preparation for video recording. Individuals performing the skills prepared scripts prior to video recording that were peer reviewed for accuracy by the remainder of the team. The scripts were written adopting the first person point of view 'think aloud' style (Lynch et al., 2012).

The task of ensuring high quality audio was managed differently at two partner universities: dissatisfied with the quality of the GoPro sound quality, the Deakin team captured audio using the Zoom H2 audio recorder coupled with a lapel microphone during skill performance and filming, while the USC team opted for voice overs that were recorded in the sound studio after each stage of filming was completed. The audio for the USC videos was recorded by voice specialists recruited from among the drama students at USC. These choices were made by respective teams based on available equipment and recommendations from media specialists. The scripts for the narratives were written by each team member responsible for filming particular skills.

Post production

Post production was concluded by media specialists at USC and Deakin. The video footage was edited on Mac computers using Final Cut Pro software in high definition (1080i) and saved in mp4 format. Video scenes were edited to match the script for each skill. Unnecessary scenes were deleted. Voice-overs, titles, graphic overlays and captions were added to clarify the steps for clinical skills being performed. The screen captions and text styles were previously agreed upon among media specialists in consultation with the project team. Video editing assisted in enhancing the video quality and on-screen communication.

After video editing, draft videos were shared between team members using a file transfer service. Videos were reviewed and re-edited where required based on recommendations from team members and results from a large scale survey (n=144) that was conducted among nurse and paramedic educators and students. Several videos were re-edited with on-screen text clarifications and guidelines. Some videos were reshot based on feedback for accuracy, i.e. the oropharyngeal airway video that was refilmed to show a device measurement method for consistency with professional consensus and to provide side views for teaching clarity.

Uploading to YouTube

Completed videos were then uploaded to the EIMP YouTube channel to enable free public access without login and to use the embed function of the YouTube channel to embed the videos into the project website. A YouTube login account was created for the project and all videos were uploaded as a single playlist. Then the HTML codes for videos were copied using the share function of the YouTube channel to be later used for embedding the video links directly onto www.expertinmypocket.com.au.

Creating a YouTube channel that the project team managed instead of the one that was administered by the university media department, provided decision-making independence and faster access to the channel for prompt uploading of videos in case further edits were warranted.

Over an eight month period the top three most viewed project videos were the nursing skills: injection preparation, sublingual medication and intramuscular injection. Three paramedic skills were among the seven most popular EiMP videos on YouTube: taking a blood pressure using an aneroid sphygmomanometer, peripheral venous cannulation and twelve-lead ECG.

Table 1.
EiMP YouTube clip popularity (at 8 months since upload)

Order of Popularity	Skill	Number of Views
1	Injection preparation	567
2	Sublingual medication	347
3	Intramuscular injection	308
4	Taking a blood pressure using an aneroid sphygmomanometer	254
5	Peripheral venous cannulation	225
6	Twelve-lead ECG	214
7	Oral medication	214

Embedding to website

The project established a freely accessible website www.expertinmypocket.com.au to host the videos and other teaching and learning resources. The project team used the services of an external web designer to design the look of the website. Central to the project designed logo and website header became screenshots from the completed videos. The website design and content was agreed upon as a team with involvement from both universities and members providing ongoing input. One team member was responsible for using the WordPress environment to upload and update the website content. Extensive testing by the team was undertaken before publishing the website content online. Comment functionality was provided for user feedback.

Due to upload size restrictions, the videos were embedded to the EiMP website using the URL links copied from the project YouTube video channel. Prior testing of the website showed benefits of creating separate video sites for viewing on computers and on mobile devices. For faster retrieval time using mobile devices, a single page was created to host all 30 videos for mobile linking. On this page, clickable video thumbnails were created using lightboxes which were modified for each individual video by copying the YouTube video ID into the right place on the string (see figure 1 for example of a lightbox). A website menu was designed to enable access from mobile devices.

For better viewing on computer screens, 30 separate pages were created on the project website; one for each video. For these videos, individual video screenshots were used as clickable links that opened the video to play in the same window. Videos were at this stage categorised under submenus for quick overview: resuscitation skills, vital signs, procedures, medication and infection control.

All videos regardless of viewing method provided the screen re-sizing and playback options. A short, 1-2 sentence introductory text about the skill being performed was added under the video together with a download link to the relevant skill sheet.

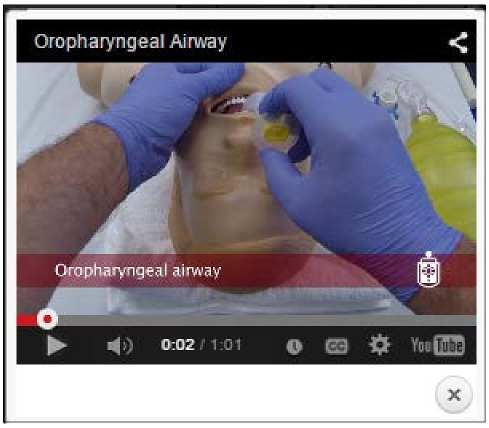

Figure 1. The EiMP Oropharyngeal video using mobile view

Creating QR codes

Once the video resources were embedded into YouTube and linked to the project website, Quick Response codes (QR) were created for scanning by mobile devices to quickly connect the user with the requested video. QR codes are innovative two-dimensional barcodes that when scanned by mobile phones, tablets and smartphones instantly link to the data the codes represent (Mohamed, 2014), which in the case of project videos were the URL links that hosted the individual video resources.

The visual representation of a QR code is an organised square block of black and white pixels that the mobile phone cameras, when placed over the QR codes, can identify and draw data from to connect to the URL. The QR codes can be additionally used to link to phone numbers, text messages and images. The appropriate QR code reader software is currently not pre-installed on most mobile devices, but can be downloaded without cost from places such as Playstore or iTunes (Mohamed, 2014; Ramsden, 2008). The EiMP project team tested a variety of QR code reader applications and uploaded a QR code application recommendation for QR Droid to the project website.

The QR codes for the project videos were created using the free online conversion services at https://www.the-qrcode-generator.com. Each video URL was copied into the conversion field on the webpage to instantly create the individual QR codes. The QR codes were then saved in eps-format to insert them into the one-page information sheets (Adobe Illustrator files) that accompanied each video on the webpage. These skills sheets were then converted into pdf format and uploaded to the project website ready for download by educators and students. Later the QR codes were printed and attached to relevant laboratory equipment (i.e. blood pressure machines, ECG monitors, etc.) to enable just-in-time access to videos illustrating the correct technique. Additional ways the project used QR codes to link to these videos included use on poster presentations to create awareness about the project resources at conferences and professional seminars.

At the University of the Sunshine Coast, the students were given access to the EiMP videos using QR codes during in-class learning, which consistent with the results from the pilot study, where these were well received (EIMP, 2015; Lynch et al., 2012). The focus groups conducted with 14 paramedic students by EiMP in September 2014 confirmed that students at USC frequently accessed these videos using QR codes to check procedural details of specific clinical skills and appreciated the quick access and short downloading times using tablets and mobile devices (EIMP, 2015).

Research shows growing interest and student support for the application of QR codes for fast information retrieval (Lynch et al., 2012; McAllister et al., 2013; Mohamed, 2014). Students feel more engaged with learning resources that they feel they can actively interact with (Shephard, 2003). However, despite recent technological advances that support QR code usage, it has been evidenced that students are often unaware of their application (Mohamed, 2014; Ramsden, 2008). Literature confirms that strategic placement of QR access codes that enables easy and flexible student access can radically increase their use (Mohamed, 2014). From an educator's viewpoint, QR codes are easy to create and update. This is a necessary feature in order to adhere to modern evidence-based practice. Project outcomes confirm great potential exists for further integration of QR code technology as a teaching and learning strategy within tertiary education.

Discussion

The Expert in My Pocket team experienced various challenges before, during and after filming the videos that led to valuable lessons regarding the best practices to produce clinical skills videos for teaching in higher education (EIMP, 2015). The challenges were related to finding best possible settings for filming, on time availability of and familiarity with equipment, technical issues and time pressures (see Appendix 1).

Despite challenges, the project team confirmed an overall positive experience from engagement with the project and expressed confidence in the value of the teaching resources produced. Participants advised that despite a few technical issues that required addressing, producing the video resources was not a skill intensive or technologically overly difficult endeavour. "*You do not need a lot of equipment or skills to produce these videos*," one team member advised. Another team member welcomed the video production experience as a reflection and learning activity:

> I guess doing the videos provided me personally with a new skill set. So that was really good learning. […]…looking at it from the angle of what you have seen, what the students have seen – that was really good learning. You know, some things that you do as a clinician, you just do automatically and really quickly, but actually having to think through the skill was actually really good reflection as well.

Several team members appreciated the video production as an opportunity to better relate to the student experience:

> It is interesting that…if you have been practicing it for a while, it [performing the skill] becomes quite easy, a bit like riding a bike – the more you do it, the better you get – even to a point where you do not even have to think about it, it just becomes automatic. But when you try to deconstruct the various components of that skill, it is actually very complex, and I think that is helpful for an educator, because it forces you back to a point where you are looking at the world from a student's perspective, and try to think about how they see the skill – it is not automatic for them, because they have not practiced it enough to achieve that level of automatic performance. …[…]…the process of deconstructing these skills highlights just how complex some of them are: how many steps (interrelated steps), and how important it is to get things done in a certain sequence. So, it is actually helpful to do that, because it puts you back in the student's shoes.

Team members acknowledged the importance of scheduling sufficient time into the filming sessions for practice, which was highly dependent on the complexity of the skill that was being performed. Time constraints were pointed out by several team members, which highlighted the importance of scheduling additional time into project planning.

> I just need to book three times longer than I think I will take. It takes a lot longer. It took me…[…]... a long time, so I think it is really an individual, personal thing. And frustrating. And I think it also comes back to the skill set that you are trying to achieve, or trying to video. So, if something takes you five-ten minutes in real life – you are not going to catch it in half an hour of video trialling.

Some of the challenges faced were associated with learning to use the equipment. Ensuring chest or head mounted camera stability was a recurrent issue during filming. Unlike the nursing skills that were performed with little movement on behalf of the skills performer, mobility was more of a challenge for filming of the paramedic skills videos where the learner needed to see what was happening concurrently with the patient and on the monitor (i.e. in the case of the continuous cardiac monitoring skill). This increased the performance complexity level for the skill presenters. The chest and head harnesses were used to fix camera in position, which effectively solved the issue of having someone hold the camera, but it also meant that the camera was highly sensitive to the skill presenter's movements.

The restrictions of the GoPro camera field settings (medium was frequently used ahead of the wide field view to keep extraneous information out of the frames) meant that the person performing the skill had a very narrow range of movement. The demonstrator had to be highly aware of how he/she moved during skill performance and several takes of each skill were needed to gain awareness of camera angles and excessive movement.. The iPad with camera preview was placed in front of the skill performer just outside the frame to monitor movements. Often, another team member had to hold the iPad up in front of the presenter during filming at precise angle to provide a preview of what the camera was filming to ensure movements stayed within the frames. In some cases the only way to warrant the head mounted camera movement stayed under control was to fit the skill presenter with a neck brace, which was uncomfortable for the wearer and limited his/her view of own hand movements. At other times the video shoot required the demonstrator to kneel on the ground, which for an extended period was uncomfortable and hurtful to the knees of the performer. For these reasons, the first person point of view was at times challenging to film. One team member confirmed: "There are just some things that you cannot do from the first person point of view…[…]…And we did not realise that until we tried to produce the videos."

Another layer of complexity was added by the different facilities the project partners had access to use for filming. The goal was to conduct video shoots in simulated clinical settings. Deakin University had suitable and well-equipped nursing laboratories readily available, whereas the USC team had to experiment with filming outdoors (which was sometimes too windy), in the media studio (too much floor space visible on video) and in confined spaces of the paramedic laboratories.

> And we really took a long time trying to get the angles right, and the space right, and the lighting right. Whereas Deakin, in their nursing labs, they could pull the bed screen around and everything was screened off for easy filming. We did not have those facilities and we could not get into those facilities. So, another level of complexity. If we are going to write protocols…[…]… of how to produce these things [videos] a standardised

environment to film in would be nice, so that we could have screens that pull around to ceiling to floor level to cut out any of that clutter in the background," one team member advised.

The challenges faced by the project team throughout video production confirmed EIL's (2013) statement: "*Wearable cameras, for instance, allow a learner to engage simultaneously as observer, reporter, and participant, enabling more detailed life-blogging and providing a subjective point of view for digital storytelling*." The important lesson learnt from video production was that creativity, open communication and efficient teamwork solve most challenges encountered during video production.

Conclusions

Thirty introductory videos for teaching nursing and paramedic clinical skills were developed by an interdisciplinary project team. The production process was perceived by team members as a good learning opportunity that highlighted benefits in filming from a first-person perspective, as well as some specific challenges of using wearable technology for creating clinical skills videos. The production of a repository of clinical skills that were accessible anywhere at any time via QR codes was seen as a very valuable learning resource.

The findings suggest that videos filmed from a first person point of view are equally engaging for the educators who produce them for teaching purposes, and for students who use them for learning. However, this aspect needs to be investigated further. Further research in this direction could explore student engagement with generating clinical skills videos to support assessments. For example, the educators could video record the students performing the skill using the first person point of view in the tutorial. The recorded videos could be used for marking and moderation purposes across the whole teaching group. Also, students could independently produce videos, where they perform the clinical skills and submit these videos for marking. This way, students get as many attempts as they need to record their performance, practicing to the point where the student video matches the expert video.

As such the research team is testing the created video materials at a number of Deakin and USC courses to receive feedback on their efficiency on the video usage as part of tutorials – during preparation, discussion and for in-class assessments.

The next step in the utilisation of wearable technology for clinical skills recording and teaching could be to experiment with a variety of non-intrusive, light cameras that are not as restrictive of movement for the person who is performing the skill. These 'spy' cameras could be attached to the clothing of the skill performer (lapels, ties, necklaces), or hidden in portable artefacts (pens). It is clear that research in the learning of paramedic and nursing clinical skills using first person point of view video learning materials needs to continue.

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Appendix 1. Overview of Challenges Met in Video Production

Challenge	Detailed Overview	How Challenge was Addressed
Camera view	Repeatedly encountered issues related to setting up the scenes, including distracting items crowding the camera view, cords in view, stains on floors and walls, etc.	Block walls, furniture and carpet were used to cover stains and remove unnecessary items from camera view.
	The camera angle was problematic and view limited.	Skill performer rehearsed to be aware of camera angles at all times. The iPad with camera preview was placed in front of the skill performer just outside the frame to monitor movements.
	Skill refilming was scripted to take side shots of the procedure, which had to be shot at a precise angle.	Camera was held firm on top of an adjustable tray table to control movement during filming.
	Skill (i.e. OP airway) required using a narrow camera view to get a sufficient close-up. This made keeping the whole head of the manikin and skill performer's hands within the frame problematic.	The demonstrator had to be very aware of how he moved to produce the smoothest results. In the rehearsal, using the iPad with GoPro mobile application preview, he memorised his positions for key moments. He adjusted his body position and practice although it felt unnatural and artificial.
	There was a significant delay (5 sec) between camera and iPad used for viewing what camera was filming.	Mobile phones with GoPro application were used for recording and playback that decreased the delays.
Equipment	Video production facilities lacked certain equipment required to perform the skills.	Various equipment were sourced from other facilities between rehearsals.
	For cost efficiency, a new set of defibrillation pads could not be used for every defibrillation skills rehearsal and video shoot.	The defibrillator pads were reused with their packaging sticky taped together to appear new on camera.
	The camera batteries ran flat.	The first camera battery was removed and attached to a computer to recharge and second battery was concurrently used for filming. First battery was later reattached to the camera. Batteries were recharged to full prior to each filming session.
	Remote control required to adjust the height of patient bed failed to operate.	Laboratory technician was called to consult regarding issues with remote control, problem was fixed and bed was adjusted to required height for filming.
	ECG machine printer was out of paper	New paper was inserted into the ECG printer
	Lighting in the lab – ambient and florescent	Studio lighting was used exclusively and adjusted between scenes.

Lighting	Lighting in the lab was problematic leaving shadows in the frame.	Lighting was adjusted to minimise shadows affecting filming quality. Studio lighting was used exclusively. 3 lights.
Audio	When refilming, skill had to be performed to an existing audio that dictated pace.	The existing audio was played while filming the skill.
Skill complexity level	Skill was long to film and consisted of multiple performance stages.	Skill was filmed in multiple takes and edited together into a single video in the studio. The numbers of successful takes were recorded for editing.
	Skill (ECG) had to be performed with technical precision.	Skill (ECG) was rehearsed multiple times and places for the electrodes on patient's chest were marked with a red pen.
Performer specific challenges	Since the defibrillation video was best performed with the demonstrator kneeling on the ground, kneeling for extended period in this position was uncomfortable and hurtful to the knees of the performer.	The demonstrator stood up to stretch legs between skill rehearsals and recordings.
Time	There was limited time for script rehearsal.	A script for each video was written beforehand and available time was used efficiently. Skill was rehearsed multiple times.
	There was not enough time to film within the scheduled timeframe.	Sufficient time was built into the schedule for scene set up and rehearsal to save time during filming.
Refilming	The need for refilming was discovered only after end of video shoot.	Vigilant observation was required to ensure skill was performed precisely. It was deduced that several staff members must be present to assist with filming.

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