The technological integration of a simulation pedagogical approach for physical education: The GoPro PE trial 1.0

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Abstract

Teacher Education programs have a unique and important role to play in assisting pre-service teachers (PSTs) to deliver developmentally-appropriate physical education (PE) classes. Despite this important role, the 'physical' nature of PE classes and the growing externally-focused environment of online tertiary education programs can make it challenging to provide access to real-life practical PE learning experiences for PSTs. One possible solution to this is facilitating simulated on-campus learning experiences to those online. A form of technology that has emerged within educational contexts that has the potential to simulate PE learning and address a number of key learning areas is GoPro video recording devices. To date, there is little investigation of the potential of simulating PE practical learning processes via GoPro video technology. The aim of this paper is to report on teacher field note observations and reflections underpinned by a Technological Pedagogical and Content Knowledge (TPACK) framework. It was revealed that the suitability of GoPro technology was enforced by its portable nature and the ability of the camera to capture point-of-view vision. It is vital for teacher training programs to enhance PST 'readiness' by providing simulated experiences from PE practical classes to ensure graduate standards are met.

Introduction

The effective preparation of physical education (PE) teachers in our modern society is vital. The readiness of our future PE teachers within the overall subject of Health and Physical Education (HPE) continues to be evaluated as the training methods, tools and delivery to facilitate PE teaching preparation continues to evolve (McMahon & Dinan-Thompson, 2014). Yet questions still remain as to how technology can be integrated within PE teaching in a pedagogically appropriate manner (Juniu, 2011). In 1998, Shulman reported that teachers should have the ability to demonstrate content knowledge via pedagogical methods that are adaptable to the learning profiles of students irrespective of the educational setting (for example, practical classes on basketball courts). Due to the practical nature of PE often being taught away from structured, seated classrooms, it is important that PE teachers consider technology integration that can be applied beyond the confines of a classroom to capture and enhance student engagement (Juniu, 2011). Pre-service teachers (PSTs) must develop the appropriate pedagogical knowledge and subsequent application of a variety of teaching skills to use in practical contexts that often differ from other teaching disciplines (Hyndman, 2017).

The expectation to prepare Physical Education Teacher Education (PETE) PSTs for innovative teaching practices is reflected in the Tertiary Education Ministry Advisory Group (TEMAG) recommendations and Australian Institute for Teaching and School Leadership (AITSL) standards. The recent Australian TEMAG recommendations emphasise the application of innovative technology, facilitating methods to enhance 'classroom readiness' and 'classroom delivery' of PSTs (TEMAG, 2015). Additionally, the AITSL graduate teacher standards describe the importance of administering a range of teaching strategies and engaging in professional learning, especially relating to the use of innovative technology (AITSL, 2011). Yet in the United States, it has been reported that the use of technology within PETE programs has not been effectively implemented (Leight & Bechtel, 2010). Guidelines for teacher education preparation continues to involve the use of technology despite the occurrences of lackluster facilitation of technology to engage PETE PSTs. With this in mind, there is a significant need to consider emerging forms of technology and how innovative uses of technology can be integrated into teaching practices (Casey, Goodyear & Armour, 2016). Therefore, this paper applies a technology integration framework as a guide for PE teachers and PETE programs to consider the facilitation of GoPro video capturing technology to simulate practical PE experiences.

Method

Technology integration framework

Learning activities should consider the needs of PSTs, the type of content and type of setting (Niess, 2005). By identifying learning objectives and activities educators need to also consider the integration of technology into their pedagogical practices (Harris & Hofer, 2009). The application of a framework for teaching with technology is important to guide and support teachers' delivery. The framework proposed in this study is the 'Technological Pedagogical and Content Knowledge' (TPACK) framework (Koehler & Mishra, 2008). The TPACK framework is grounded in the relationship between teachers' understanding of content, pedagogy, and technology and how these interconnect with one another to produce effective teaching (Koehler, Mishra & Cain, 2013). The TPACK framework is relatively new, yet has been a catalyst in influencing a range of teacher education practices and development. In the present study, the TPACK framework underpinned a series of questions that aim to support the planning and development of learning activities that incorporate technology (Juniu, 2011). The TPACK technology integration questions to guide teachers are outlined in Table 1.

Table 1. *Technological Pedagogical and Content Knowledge (TPACK)' framework guiding questions for technology integration*

TPACK Stage 1 - Content
• What are the desired learning outcomes/curricular objectives for the content being taught that you plan to target with technology?
TPACK Stage 2 - Pedagogy
• What pedagogies/teaching strategies are being used?
TPACK Stage 3 - Technology
• What digital technologies are being used in teaching and learning?
• What digital technologies are pedagogically appropriate?
• What are the functions, affordances and constraints?
TPACK Stage 4 - Is It Effective?
• How effectively does the technology integration enhance or support the pedagogical strategies being used?
• How does the technology integration improve or detract from the teaching and learning experience?
• How do the PSTs understand the concepts in the technology-enhanced learning activity?

Teacher field note observations and reflections

During the process of implementing the technology, descriptive qualitative accounts were documented by the researchers via field observations (Bogdan & Biklen, 1998; Morse, 1994). Protocol considerations of using the technology as a teaching tool were documented in the field observations according to visual (what was seen), auditory (what was heard), experiential (what was experienced and engaged in) and cognitive considerations (what was thought of) (Bogdan & Biklen, 1998; Morse, 1994).

Results and discussion

TPACK Framework Stage 1 - Content

The aim of the PETE unit being facilitated was for the PSTs to explore the content and pedagogy of HPE specifically for children from pre-school to primary levels. The unit focused on developing PST understanding and application of teaching practices relating to the development of movement, physical activity and health awareness. Curricular content and the development of hands-on learning experiences in HPE were also explored.

The outcomes of the PETE unit were for the PSTs to:

1. Apply the Australian Curriculum: HPE (AC:HPE) (ACARA, 2016), and the Early Years Learning Framework (DEEWR, 2009) to the construction of learning experiences in HPE;
2. Evaluate strategies for creating an effective learning climate for HPE instruction;
3. Compare and critically reflect on teaching and learning practices in HPE;

4. Identify, retrieve and evaluate relevant information from traditional and web-based sources;
5. Respect and accommodate diversity and recognise ethical issues in teaching and learning of HPE.

TPACK Stage 2 - Pedagogy

There were a number of PE pedagogical models applied within the introductory unit's practical content for the PSTs to learn how to design and enact the AC: HPE (ACARA, 2016) for future student accomplishment of curriculum achievement standards (see TPACK Stage 1). Models based practice has been seen as a 'blueprint' to design and enact learning within PE to tightly align with content and outcomes, in order to address the educational value of PE (Kirk, 2013). The first and main pedagogical model utilised within the unit was the Game Sense approach (Pill, 2016) which was suited to providing insight to PSTs of the tactical, technical and sport skill learning intentions of the AC: HPE (ACARA, 2016). The model provided a context for physical activity problem solving and guided exploration of game problems (Pill, Harvey & Hyndman, 2017). The PSTs were encouraged to think deeply about meaningful, high intensity game situations within a student-centred context that differed from more traditional directive and drill-based PE. Games were based around striking/fielding (hockey, cricket), invasion (tag games, soccer), net/wall (tennis, badminton) and target-based (lawn bowls, ten pin bowling). The games were used to question PSTs in order to shape, focus and make visible player learning by facilitating understanding of what to do in the context of play, how to do it and how to execute game solutions through the use of guided and open-ended questions (Pill, 2013). The CHANGE-IT formula (Coaching; How Scoring Occurs; Area or Dimension; Number of players; Game rules, Equipment; Inclusion for learning needs & Time of the game (Schembri, 2005)) was regularly applied to modify the game constraints to create playing conditions that "focus attention on specific technical or tactical game understanding" (Pill, 2013, p. 9).

A second pedagogical model utilised was the Sport Education Model (Siedentop, Hastie, & Van der Mars, 2012) which has been described as the most theoretically and pedagogically developed across all models based practice (Kirk, 2013). The Sport Education Model was used within this introductory PE unit largely for the selected sport of Badminton to develop PSTs' understanding of sport tactics, techniques, traditions, roles, teamwork and rules. The use of pedagogical styles such as task (station) based delivery via tabloids around fundamental movement skills and tasks were also enacted. Moreover, the PSTs were introduced to a host of partner/peer based movement challenges and more general physical activity movement problems to solve throughout the unit (for example, creating movement sequences, activities using modified equipment, communication challenges and no equipment).

TPACK Framework Stage 3 - Technology

What digital technologies are being used in teaching and learning?

A method that has been used to re-enact strong interactions that occur within teaching is simulation pedagogy. Within teaching and learning experiences, simulations have been described as facilitating teaching and learning experiences that reflect the characteristics of life-like experiences and moments (Murray, Grant, Howarth, & Leigh, 2008). Simulations are characterised by providing an environment that is created which develops a person's interaction with real experiences (Bell, Kanar, & Kozlowski, 2008), subsequently improving the uptake of skills being taught and learning objectives (Cook & Swift, 2006; Lane, 1995). Previously, simulation teaching pedagogy has been applied within university systems via methods such

as 'SecondLife', 'Voki' and 'Electronic Gaming'. 'Voki' has been used to simulate an instructor and instructions via a talking on-screen avatar (Anderson, Page, & Wendorf, 2013). 'SecondLife' was developed as a virtual setting in which students can connect, socialise, learn and create through a process of free text and voice chat (Warburton, 2009). The most relevant form of simulated teaching pedagogy to the discipline of PE has been Electronic Gaming (the use of games to solve complex learning situations) (Liu, Cheng, & Huang, 2011).

Electronic methods of learning have been described as having strong potential for practical PE delivery (Papastergiou, 2009). Simulated vision of tennis, football, basketball, and soccer within sport video games, have served as an instructional resource for providing PE PSTs with opportunities to participate in a virtual environment (Kim & Hyungil, 2007). More recently in practical PE, an emerging form of technology delivery has emerged known as 'exergames' which consists of interacting with digital game components through the process of physical activity involvement (Lieberman, 2006). 'Exergames' have provided a platform for PSTs to participate in dancing (via dance pads) cycling (via bike ergometers) and other sports through the use of tracking cameras and motion sensors (capturing golf, soccer, tennis, archery, basketball & other sporting movements) (Lieberman, 2006). This electronic shift has evolved from more historic forms of electronic devices such as joysticks, keyboards and a computer mouse (Lieberman, 2006). These forms of electronic avenues for PE teaching have had some evidence of student improvement in PE engagement and participation in the past (Lieberman, 2006; Papastergiou, 2009).

Despite such electronic platforms enhancing the learning experiences of university PSTs across disciplines such as science and medical education (Cardoso et al., 2012; Frøyland, Remmen, Mork, Ødegaard, & Christiansen, 2015; Kelly, Lyng, McGrath, & Cannon, 2009; Kindt, 2011; Metcalfe, Jonas-Dwyer, Saunders, & Dugmore, 2015; Roshier et al., 2011), facilitating simulated teaching experiences that resemble more 'life-like' and 'actual' practical learning experiences in PE has often been overlooked. The practical nature of the PE discipline (Hyndman & Pill, 2017) and reduced access for externally based PSTs (for example, in regional and remote locations) justifies the use of simulated pedagogical methods to enhance practical PE classes for this particular cohort.

Video capture to promote simulated learning experiences for pre-service teachers

The use of high quality video footage as educational resources for teaching has resulted in many benefits to students by connecting theory to practice, promoting critical reflection, increasing learner engagement and fostering deeper learning (Lau & Roeser, 2002; Lynch, McNamara, & Seery, 2012; Roshier, Foster, & Jones, 2011). Ensuring that recorded content captures key learning processes and connecting with students on more than one occasion through replay can provide strong opportunities for students to direct their own learning experiences (Kelly et al., 2009). Video footage from practical classes can also ensure students can interact with learning at their desired time, location and pace (Kelly et al., 2009). The potential to view correct procedures around role modelling, demonstrations, skill execution and peer interactions in PE can follow the learning delivery of other professions such as medicine (Hibbert et al., 2013). Additionally, the anxiety of undertaking performances and demonstrations on the spot can be reduced by introducing practical techniques and skills in the comfort of students' own settings (Cardoso et al., 2012). Capturing video of practical experiences and delivering this via mobile technology has the potential to provide useful learning experiences through the facilitation of a diverse range of learning content that is easily accessible and encompasses online convenience (Cardoso et al., 2012; Hibbert et al., 2013; Kelly et al., 2009; Lynch et al., 2012; Roshier et al., 2011).

TPACK Framework Stage 3 - Technology

What digital technologies are pedagogically appropriate?

The 'practical' nature of PE is reflected in its title. Australia's teacher education programs have an important responsibility in ensuring PSTs learn to facilitate PE classes that are developmentally appropriate, and ensure that content is delivered efficiently and they are able to manage practical classes effectively (Hyndman, 2014; Hyndman & Pill, 2016). The preparation of PE teachers needs to be optimised to ensure PSTs can overcome barriers such as impaired confidence to delivering safe, well structured, well planned and managed PE lessons (DeCorby, Halas, Dixon, Wintrup, & Janzen, 2005; Morgan & Hansen, 2008; Hyndman, 2017). With an emerging externally-focused teacher preparation environment, the practical nature of PE classes (especially in university systems) reinforces the importance of enacting life-like PE practical experiences for those learning online (McMahon & Dinan-Thompson, 2014). Universities need to consider a range of avenues to ensure PSTs are 'teacher ready' and can effectively deliver the AC:HPE (McMahon & Dinan-Thompson, 2014).

The introduction of mobile (portable) video technology has resulted in increased abilities to record more action-packed practical and sporting moments (Chalfen, 2014; Skiba, 2014). By wearing video technology with 'point-of-view' angles, video can record practical activities in which the audience feels part of the action taking place (Chalfen, 2014). The potential of mobile video devices to have a positive impact on the delivery of PSTs' learning online is therefore powerful. Mobile video devices can be utilised to portray interactions and skills through the point-of-view of those facilitating learning processes (for example, teachers and lecturers) (Lynch et al., 2012). With online delivery in university systems continuing to emerge, the prospect of better capturing learning of a practical nature could develop into a strong desire for those wanting to connect with more life-like learning experiences from the comfort and convenience of their electronic devices (Lynch et al., 2012; McAllister, Searl, & Davis, 2013).

Despite the emergence of electronic gaming within university courses to facilitate simulated learning experiences (Kron, Gjerde, Sen, & Fetters, 2010), the application of mobile video to capture learning for online PSTs within practical PE can improve teaching readiness. Although research into the use of mobile video footage in practical PE has been limited to one study in the United States (Baghurst, 2016), to our knowledge, there has been little empirical investigation into the potential of trialing GoPro technology to simulate practical PE experiences. Therefore, there is a need to explore the potential of GoPro integration for online learners of PE within an Australian teacher education program.

TPACK Framework Stage 3 - Technology

What are the functions, affordances and constraints of GoPro technology?

In contrast to more historic uses of digital video footage for enacting and recording key moments, GoPro technology (Figure 1) is innovatively designed to capture 'action packed' practical footage. The GoPro technology is attached to the body, equipment or vehicle and can record point-of-view high definition vision (Wellard, 2015). Wearable video technology has been revealed to encompass strong prospects for investigating social settings (Chalfen, 2014). The emergence of GoPro technology by capturing action experiences ensures there is potential to record a wide variety of kinaesthetic, sensory and cognitive experiences (Wellard, 2015). The GoPro video technology is also built to buffer substantial forces as illustrated by being used to video Felix Baumgartner's 18,000 mile high 'Space Jump' (Redbull, 2012). The match-boxed sized technology can provide those that are externally enrolled in PE learning experiences point-of-view vision.

Figure 1. *The GoPro Hero+ camera proposed for the PE teaching simulation*

TPACK Framework Stage 4 - Is it effective?

How effectively does the technology integration enhance or support the pedagogical strategies being used?

At the beginning of the semester, PSTs learning PE via on-campus mode were invited, and consented to GoPro technology recordings being utilised to engage those enrolled online. The footage was then uploaded to a privately linked YouTube page (100% consent/response rate). The intention of using the GoPro technology to record PE practical teaching and learning experiences via point-of-view audiovisual footage was outlined to the PSTs to simulate the classes.

The GoPro was used to capture key practical view-points from the perspective of the PSTs and the lecturer. Capturing the practical learning from multiple view-points allowed external PSTs to experience the audiovisual elements similar to the on-campus PSTs. The point-of-view video recorded how different activities were delivered across a range of sports/games (for example, invasion, target, striking, net/wall), and how different pedagogical approaches (for example, sport education, game sense, tabloids, cooperative learning) were implemented. The GoPro footage was also able to capture key learning points for those who were absent from on-campus learning.

The video footage was housed on YouTube so that the vision could be repeatedly streamed to allow PSTs to revisit their learning and reflect and critique their physical skills. Key elements that can enhance classroom readiness were also captured during the on-campus video recording which enabled the PSTs to engage with more broader concepts of teacher readiness including classroom management, lesson planning, scaffolding, positioning and lesson transitions.

TPACK Framework Stage 4 - Is it effective?

How does the technology integration improve or detract from the teaching and learning experience?

Despite the benefits of the GoPro, key issues for consideration arose. The GoPro technology did have a presence during the practical activities as the PSTs were aware of the device picking up not just learning, but other behaviours. Early in the teaching session there was an element of intrusiveness that had to be overcome. This was noted as both positive (attempting tasks with more vigour), yet also a negative (avoiding the wearer and not wanting to join the

wearer's group during some activities). It was evident that the PSTs became more accepting to the innovation over time, once the benefits of increased engagement and better connection of the practical footage for external learners became evident. The technology was also in tune with the group's digital worlds.

Given that capturing the practical PE class footage via GoPro technology was a trial, there were a number of areas that will need to be considered for future use. Key considerations include the need to capture all angles of vision and ensure sound is recorded in a way that prevents shakiness when wearing the GoPro. In order to improve the teaching and learning experience, it will be important to consider whether administrative support is required for downloading, editing and uploading the point-of-view vision for PSTs. It was noted that over the duration of the semester, there was a drop off in the number of PSTs accessing/streaming the GoPro video footage which could be related to the burden of busy assessment periods.

In order to capture the vision, consent from PSTs also needs to be obtained prior to the beginning of practical sessions to ensure that the wearing of the GoPro is voluntary and all PSTs are comfortable with the recording of the activities. Early preparation of the recordings is also important to gauge lighting, sound, camera angles and other audio-visual settings as many PE contexts vary (especially in size).

Other considerations to ensure that the GoPro technology can be utilised to improve the teaching and learning experience in practical PE includes having a memory card for video storage, determining how much video to capture (for example, just key moments or entire lessons, muting inappropriate on-campus conversations), storage of video capture (and upload to learning platforms or YouTube), the possibility of microphones for large outdoor PE spaces, regular monitoring of battery life to ensure recording of crucial practical experiences are not lost and the preparation of appropriate editing software (for example, Apple iMovie). Other considerations include the types of 'mounting' equipment to body parts such as chest straps (less impact on hair, less tilting, less sweat impact) when compared to head mounting straps.

TPACK Framework Stage 4 - Is it effective?

How do the pre-service teachers understand the concepts in the technology-enhanced learning activity?

Although the next phase of GoPro technology integration research is to assess PSTs' understanding of concepts from technology-enhanced learning via survey tools or focus group discussion, the field note observations have determined that the intentions of on-campus classes could be captured and transferred to those learning PE content via external modes. It was evident that those learning externally could take part in a virtual class experience with point-of-view vision of what was happening within practical classes to improve teacher readiness and assessment preparation.

Synthesis

The facilitation of the GoPro technology to capture practical on-campus PE classes was able to ensure the technology facilitated PSTs' understanding of concepts related to the Australian Institute for Teaching and School Leadership (AITSL) standards:

- 'Assess, provide feedback and report on student learning' (for example, the PSTs were able to gain understanding into methods of delivering feedback during practical PE, develop insight into assessment methods that will be applied during practical PE; Professional Practice, Standard 5; AITSL, 2011);

- 'Create and maintain supportive and safe learning environments' (for example, PSTs were able to gain understanding of types of behaviour management strategies, important safety components to apply during practical PE activities and inclusive strategies in practical PE; Professional Practice, Standard 4; AITSL, 2011);
- 'Plan for and implement effective teaching and learning' (for example, understanding strategies to structure, plan and sequence practical PE, strategies to set learning objectives, how to facilitate effective classroom communication via management/safety/teaching cues, use of whistle, positioning, use of voice; Professional Practice, Standard 3; AITSL, 2011); and
- 'Know the content and how to teach it' (for example, PSTs were able to learn practical PE teaching strategies, how to implement a diverse range of pedagogical strategies, connect PE activities to the AC: HPE (ACARA, 2016), understand assessment methods to apply within practical PE classes, learn how to trial the GoPro technology simulation teaching experience and how to organise content; Professional Knowledge, Standard 2; AITSL, 2011).

Summary, conclusions and implications

The TPACK framework provides a guide to the process of integrating GoPro technology within teacher education programs to simulate practical experiences. Findings from this GoPro integration pilot reveal valuable understandings for teacher education providers of the potential benefits and misgivings for implementing GoPro technology to simulate practical PE experiences for on-campus PSTs and external learners. It was revealed that there is a need to move beyond more traditional digital methods to innovatively engage PSTs' learning of PE online via the use of the emerging mobile technology of GoPro. The suitability of GoPro technology was enforced by its portable nature and the ability of the camera to capture point-of-view vision through a process of simulation pedagogy. The field note observations within the integration trial, underpinned by the TPACK framework, revealed that the GoPro technology could be beneficial for PSTs to re-visit, critique and reflect upon practical PE learning experiences and work to close the gap between on-campus and online learning delivery for external students. A number of considerations relating to storage, consent, editing, uploading, preparations and the use of chest mounting straps are also important implications for this research. It is vital for university programs to enhance PST 'readiness' by providing PSTs with simulated experiences from PE practical classes in a way that allows them to meet the AITSL graduate standards of assessing, managing and planning irrespective of their mode of study.

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