Health and Physical Education Teacher Education 2.0: Pre-service Teachers' Perceptions on Developing Digital Twitter Skills

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Abstract: The advent of Web 2.0 technologies such as Twitter are reflective of an improved capacity for global educative collaboration. Yet there is an absence of research determining the potential of social media within Health and Physical Education Teacher Education (H-PETE). The aim of this paper was to therefore determine pre-service teachers' (PSTs) perceptions of the potential of using Twitter within H-PETE training. The study was underpinned by a constructivist online learning framework. PSTs (n=35) enrolled at a regional Australian university were recruited to participate via online survey. Themes revealed PSTs perceived Twitter could be valuable during H-PETE for facilitating learning, technology engagement, capturing international insight, enhancing collaboration and communication. In contrast, PSTs described potential barriers to using Twitter relating to receiving adequate training, privacy, excessive technology use, determining Twitter's functionality and application across educational contexts. Unpacking PSTs' perceptions of the potential of Twitter within H-PETE can contribute to the pedagogical decisions made by teacher educators to improve social media uptake in PSTs.

Introduction

An estimate of 165 million students are engaged in higher education studies internationally (Marope, Wells, & Hazelkorn, 2013) with these numbers expected to rise by almost one million students by 2023 (Maslen, 2012). Tertiary institutions continue to invest time in determining key strategies to effectively teach such a mass of enrolments (Marope et al., 2013). Students born after 1982 (when the personal computer entered the world) have been entering higher education described as 'Generation Y', 'Digital natives', 'Next Gen'ers' and 'Millenials' (Perna, 2018). These students have grown up with an increased immersion in digital media products as part of this modern context with high proportions owning a personal computer (Oblinger, 2004). To meet modern study needs, universities have expanded online delivery modes to ensure greater flexibility, convenience and accessibility beyond traditional classroom boundaries for students (Garrison & Kanuka, 2004; Hyndman, 2017a). Online delivery of courses has also meant greater consideration is required into how learning resources and support can be facilitated within university classes (McMahon & Dinan Thompson, 2014; Hyndman, 2017a).

A consideration for universities in this expanding online market is to how to connect and align learning with the emergence of Web 2.0 technologies which include social media platforms such as Twitter and Facebook (Chawinga, 2017). Such social media platforms have transformed how the public can communicate across work disciplines, countries and contexts

(Casey, Goodyear, & Armour, 2016). Moreover, the educative purposes of these social media platforms such as Twitter are continuing to be unearthed by exploring the potential of tapping into students' 'personalised' social worlds to develop learning (Junco, Heiberger & Loken, 2011; Casey et al., 2016).

Twitter has been recognised by a number of studies in the education literature as being a platform to positively develop educational delivery for 'in-service' teachers (Carpenter & Krutka, 2014, 2015; Davis, 2013; Krutka & Carpenter, 2016; Visser, Evering, & Barrett, 2014). Communication via Twitter being the most commonly reported facilitator of educational practices (Carpenter and Krutka, 2016). The communication channels of Twitter are recognised as being cost-effective, allow the sharing of information and can be a catalyst for advocating for professional components (e.g. associations, disciplines) (Erwin, 2016). Twitter is also an important platform for professional development and learning (Carpenter and Krutka, 2016). Research in the USA has found general pre-service teachers (PSTs) have not been convinced about using Twitter for future students in the classroom (Carpenter, Tur & Marin, 2016) and have perceived that there are shortcomings in university teachers' facilitation of Twitter tasks (Krutka & Whitlock, 2017). Despite this, PSTs in the USA were revealed to have intentions to introduce, scaffold and reflect on using Twitter chat functions in the future (Luo, Sickel & Cheng, 2017). In Australia, reflections from academics have described challenges for generalist PSTs to use social media due to conflicts between personal and professional usage (Lemon Thorneycroft, Jones & Forner, 2012). Lemon and colleagues (2012) made three suggestions for further research: (i) further explore how PSTs perceive Twitter and its place in their professional development; (ii) conduct further research to understand how PSTs can and could use Twitter to support their teacher education preparation; and (iii) actively give voice to the perceptions of participants.

In the field of Health and Physical Education (HPE), Twitter has been found to have helped in-service HPE teachers gain collaborative support during changes to teaching delivery (Goodyear, Casey & Kirk, 2014) and has been recognised as a useful research platform to explore in-service HPE teachers' pedagogical decisions (Pill, Harvey & Hyndman, 2017). Gleddie and colleagues (2017) revealed that in-service physical educators often use Twitter and other social media in an attempt to develop an identity and presence through the projection of the most optimal teaching image of themselves. It is clear that the research into how Twitter can be used by Australian PSTs has been limited. There is also a unique gap in the international literature pertaining to Australian PSTs' perceptions of using Twitter during Health and Physical Education Teacher Education (H-PETE).

Calderón and colleagues (2017) reflected on the challenges of integrating Twitter into H-PETE coursework and noted that the use of Twitter requires content to be student-led rather than teacher-led. There has been a scarcity of empirical research to the authors' knowledge to investigate the potential of social media for H-PETE PSTs. One study has explored the professional topics PSTs discussed via Facebook and how they shared reactions to PETE experiences (Kinchin & Bryant, 2015). Yet there is scope to examine PSTs' perceptions about using Twitter for H-PETE experiences. Therefore, the aim of this study was to determine PSTs' perceptions of the potential of using Twitter during H-PETE training. The three objectives of the study were to: (i) investigate how PST perceptions of using Twitter during H-PETE can align with a constructivist online learning framework; (ii) investigate perceived facilitators of PSTs to using Twitter within H-PETE experiences; and (iii) investigate perceived barriers of PSTs to using Twitter within H-PETE experiences.

Methods

Ethical clearance was approved from the university human research ethics committee at a regional Australian University. All PSTs were contacted by an independent third party at the end of semester one, 2017 and invited to participate in the study. Project information was outlined to the PSTs with notification that they could volunteer to write open-ended responses via an online survey to determine their perceptions of using Twitter during H-PETE training. From all PSTs invited to participate who would experience HPE units within their studies (n=251), 35 PSTs elected to participate (13.9% response rate). The ages of participants ranged from 19 year olds (8.6%), 20-25 year olds (42.9%), 26-30 year olds (22.9%), 31-40 year olds (14.3%), 41-50 year olds (8.6%) and 2.9% of participants were aged over 51. The sector in which the PSTs were completing their PST training included early childhood (5.7%), primary school (40%) and secondary school (54.3%) with 94.3% being undergraduate PSTs. The majority of PSTs were regionally based (58.8%), followed by metropolitan (26.5%), rural (11.8%) and overseas (2.9%). The slightly skewed gender distribution was to be expected within PST programs and the teaching profession (Haynes, et al., 2016). The investigating researchers were not able to identify consenting PSTs' actual names at any stage throughout the study research process, as all surveys were completed anonymously.

During the final week of semester one, 2017, PSTs responded to open ended questions via a questionnaire developed through the Qualtrics online platform. The Qualtrics software program provided a university platform within the study for researchers to collect questionnaire data online. The questions that were administered were open-ended in design (e.g. essay style) to encourage detailed responses by the PSTs (Haynes, et al., 2016). Example questions within the study included:

- Identify and explain the ways in which you think Twitter social media could be (or not be) beneficial to your learning of Health and Physical Education activities;
- Detail how you think Twitter can (or can not) assist you in overcoming some of the challenges to teaching HPE;
- Explain how you think the Twitter social media platform could assist with your future delivery of HPE classes in schools;
- Explain how you think the Twitter platform could be used in future semesters to benefit pre-service teachers' learning; and
- Explain how the Twitter platform compares to other e-learning platforms that you've experienced?

The questions were underpinned by social constructivism with focuses on how the PSTs could potentially construct and apply knowledge through Twitter into their socially mediated contexts (Vygotsky, 1978) e.g. future teacher training and delivery within schools. With social constructivism underpinning the questions, it reinforced that (i) the PSTs were active participant in the learning process; (ii) PSTs could unpack interactions from their learning environments; and (iii) how such interactions in the Twitter social environment could influence their development of knowledge for future application (Steffe & Gale, 1995; Savery & Dufy, 1995). The open-ended questions were subsequently reviewed by three experts in the field with experience in qualitative survey studies.

Theoretical Underpinning

The constructivist framework underpinning the current study was Huang's (2002) instructional principles for using the constructivist approach in online learning for adults.

Based upon constructivism, the six instructional principles guide the practice of teaching and design of online learning activities and are described briefly in Figure 1.
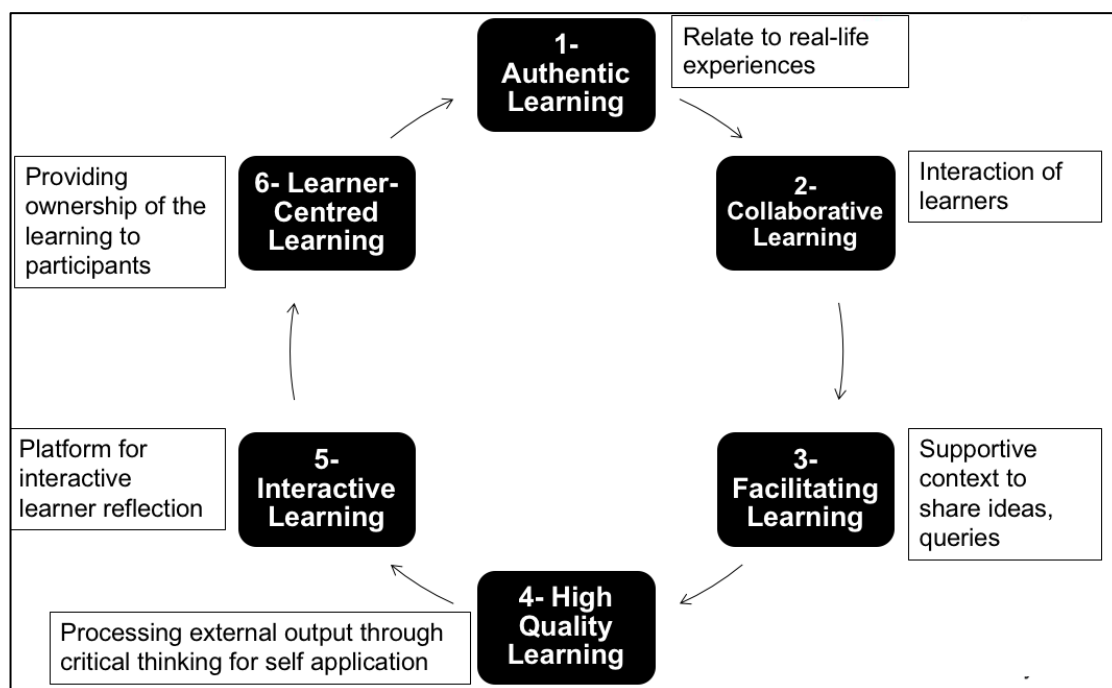
Figure 1: Huang's (2002) instructional principles for using the constructivist approach in online learning for adults.

Data Analysis

Data collected from the open-ended responses within the study were analysed by both researchers using the NVivo (version 12) software package (QSR International, 2015). Immersion, and familiarisation with the survey data was initially undertaken through systematic reading, highlighting and annotation of the data (Grbich, 2012). The coding of the survey responses was based upon the constructivist framework instructional principles for online learning for adults to identify themes. The information provided in the survey responses were used to determine the regional Australian PSTs' perceived facilitators and barriers to using Twitter during H-PETE training. Final analyses included a review using the NVivo feature of 'nodes most frequently coded' for the open-ended survey responses, to ensure themes frequently coded were included. In order to gain further insight into the PSTs' perceived facilitators and barriers to using Twitter during H-PETE training, responses were categorised according to principles of the constructivist approach in online learning for adults (Huang, 2002).

Results
Objective 1: Alignment of Pre-Service Teachers' Perceptions of Using Twitter with a Constructivist Online Learning Framework

The constructivist principles framework of Huang (2002) provided a multi-level framework to explore the range of perceived facilitators and barriers on generalist PSTs teaching of PE. Themes were generated by the NVivo qualitative analysis software which were then categorised according to the six principles of Huang's (2002) framework. The most prominent online learning principle generated from the PSTs' open-ended survey responses

was for Principle 1 'Authentic Learning' (e.g. relating to real life experiences, meaningful, appealing) with a number of themes including Twitter having an 'application to learning', providing 'engagement with technology platforms', 'keeping up-to-date', 'professional development', 'educational context', 'excess use of technology' and the 'purpose of platform'. PSTs perceived Twitter could be beneficial for HPE training via the online learning Principle 2 'Collaborative Learning' (e.g. importance of interaction with others) with themes including 'enhanced communication and collaboration' alongside the development of 'professional connections'.

Alignment was evident for Principle 3 'Facilitating Learning' (e.g. providing a context for monitoring and evaluation the level of learning) with themes such 'assessment potential', 'making things interesting', having 'adequate twitter training' and 'privacy'. For the online learning Principle 4 of 'High Quality Learning' (e.g. critical thinking of external/outside sources for valuable knowledge), the PSTs perceived Twitter had scope to tap into 'international insights'. The Principle 5 of 'Interactive Learning' (e.g. seeking learners to reflect and provide feedback) was perceived by PSTs to have potential via Twitter for 'modelling'. The final online learning Principle 6 of 'Learner-Centred' (e.g. ownership and self-direction of learning processes) was captured by PSTs' perceptions of Twitter as being a place to 'access' information. The constructivist themes and sample quotes are displayed in Table 1 and 2 (facilitators) and Table 3 (barriers).

Objective 2: Perceived Facilitators of Pre-Service Teachers towards Using Twitter during H-PETE Training

In relation to Principle 1 'Authentic Learning', PSTs perceived that there could be potential to post on Twitter how a certain topic relates to the curriculum, learn from unique codes/hashtags set up for particular topics (Table 1) and applying learning from high profile organisations and/or people, *"There are a number of high profile organisations and celebrities that use the platform which would be interesting to analyse and their posts."* Twitter was perceived by the PSTs to be a useful tool to continue the integration of ICT into classes, a modern tool to learn from and a key platform to connect with future students' 'digital worlds' which was described as having a slower uptake in HPE settings (Table 1), *"I think universities should be more open minded to connecting with students' digital worlds."* Moreover, the PSTs perceived that by possessing Twitter management skills you could be a class leader to learn from, *"I think it is an important skill to have that other teachers would be keen to learn from. Many teachers really want to know all about technology and you could be a leader if you can know how to manage Twitter well."*

Within the findings under Principle 1 of 'Authentic Learning', PSTs perceived the importance of 'keeping up-to-date' through a modern collection of resources, research, approaches, lessons, other professionals (Table 1), *"Within schools...the latest ideas around a topic can help...Without keeping in the loop, you may overlook a key curriculum update and so forth."* Similarly, 'professional development' (Table 1) was also perceived as a key facilitator by the PSTs for upgrading current teaching activities through enhancements shared by other HPE teachers, "*New ideas and professional perspectives on key HPE issues. Contemporary articles of interest, latest events and perspectives. The new ideas generated could transform mundane tasks."* The ability of PSTs to capture topics/posts from an event or leader was also mentioned as a key facilitator, *"Twitter is a professional smorgasboard and I would describe it as a 'modern library'. You can search for posts on a topic, posts from an event, key names that post etc."*

When exploring PSTs' perceptions according to Principle 2 'Collaborative Learning', the collaborative nature and professional connections were widely reported with the ability of

Twitter to facilitate conference interactions, links to other professionals, sharing of resources and ideas to aid in teacher delivery and understanding (Table 1), "*It is a modern communication tool and maybe looking into how communication can be developed between people outside of smaller regions.*" The benefits of such collaboration and communication was enforced by the PSTs, *"I think it is a good way for them to get exposure and to 'e-meet' other people in HPE. Could help them get a job or get to a conference!"* Other communicative barriers were also seen as being able to be overcome, "…*more professionally collaborative and feels more accessible to interact with those you would generally have difficulty interacting with e.g. high profile businesses, individuals and so forth.*" Moreover, there was some evidence of Twitter being perceived as able to meet Principle 3 of 'Facilitating Learning' with PSTs reporting that there is 'assessment potential' (e.g. the potential of using Twitter within assessments) of the platform to engage students with examples of different pedagogical models and online formative tasks (Table 1). PSTs also recognised that such a contemporary platform could 'make things interesting' for students in class with resources able to be accessed conveniently (Table 1).

For the online learning Principle 4 of 'High Quality Learning', the PSTs perceived Twitter had scope to tap into 'international insights' (Table 2) when delivering activities from another country and how HPE topics can be linked from global ideas posted on the platform, "*Finding out what others are doing across the world. How about cultural considerations from other places across the world for health and physical activities.*" The Principle 5 of 'Interactive Learning' (Table 2) was perceived by PSTs to have potential via Twitter for 'modelling' of how other HPE professionals conduct themselves, strategies to overcome challenges and following/learning from specific leaders, "…*it really opened my eyes to how useful it can be as a resource to find teaching ideas from different pedagogies, experts in the field, how to deliver certain aspects.*" Twitter was also seen as a modelling tool for school students, "*Kids are always looking for the latest and with world leaders often using Twitter, there is a huge brand of twitter.*"

The final online learning Principle 6 of 'Learner-Centred' was captured by PSTs' perceptions of Twitter being so accessible. The theme of 'access' (Table 2) was captured due to the PSTs' reporting an ability to gain quick ideas/feedback and the availability of information, *"...pretty much any topic or topic group is on Twitter so you can always find something"; "...could get some quick ideas or feedback on my ideas by posting with a hashtag."*

Huang's (2002) Instructional Principle for Online Learning in Adults	Theme	Quote
Authentic Learning	Application to Learning	"...retweet or quote a post with your response of how it could be useful to the curriculum." "I think there could be a perception that Twitter is far away from the practical physical nature of HPE, yet the ideas ad resources posted on their in unique codes can be applied and learned from."
	Engaging with Technology Platforms	"Positively it could be used as a modern platform as digital technology is more and more part of the global landscape." "Becoming more equipped at digital technology- which I feel is a bit slower to be taken up in HPE due to the physical focus."
	Keeping Up-To-Date	"Twitter has been amazing for developing a resource base, seeing new research, keeping up-to-date with recent studies, and linking to PE professionals." "I think it can keep you a step ahead of those not on Twitter because you might see the latest event, idea, topic, lesson approach, technology ideas and that sort of thing."
	Professional Development	"...class size grows dramatically, as students can be exposed to a range of ideas, information and opinions...people are linked by a common interest or set of information and ideas." "Within classes, it could possibly assist to upgrade knowledge of activities that I deliver e.g. if something appeared too basic, an idea from Twitter could perhaps enhance further such as via a technology/app etc."
Collaborative Learning	Enhanced Communication and Collaboration	"I am thinking that if there are active HPE teachers on Twitter that are using it regularly and posting ideas, material and other resources this could surely help my understanding and delivery in schools." "...be really up with the latest and maybe let others know of different ideas that you have seen online in Twitter."
	Professional Connections	"Links to profiles, sharing of resources, growing awareness, links to professionals and experts within the fields of Health and Physical Education, comments, information gathering, live sharing of ideas, research platform." "Exploring a key HPE conference interactions perhaps? Exploring and summarising the key events and findings."

Table 1: A sample of themed quotes from the pre-service teachers relating to the perceived facilitators to using Twitter during physical education teacher education.

Objective 3: Perceived Barriers of Pre-Service Teachers Towards Using Twitter During H-PETE Training

Similar to the online learning Principle 1 of 'Authentic Learning' as encompassing a number of facilitating themes, there were also a number of barriers. The PSTs had concerns of the application of the Twitter platform to an 'educational context' beyond higher education with most suitability seen for mature students, *"I do not see how twitter could be of assistance. Especially as young primary school students will not be using such platforms."* Moreover, the online platform was seen as possibly having the potential for having distractive options away from set learning tasks (Table 3). There were concerns by the PSTs related to 'excess technology' (Table 3) as yet another method for side-tracking students in class and being seen as unnecessary due to some seeing HPE as the avenue to escape digital platforms, *"…provide information to us, like our emails do and announcements do. So why bother introducing something new?"* Some PSTs also questioned the 'purpose of the platform' (Table 3) in how something that consists of short micro posts could relate to getting students physically active and meeting core HPE components, *"I am finding it hard to piece together how social media can contribute to the development of physical aspects in class and sport participation. From what I've seen Twitter is often used by celebrities to post messages."* Principle 3 of 'Facilitating Learning' was perceived as another barrier by PSTs of using Twitter during H-PETE training with the importance of 'adequate training' in Twitter and 'privacy' concerns of operating in a public space being reported (Table 3). Some PSTs felt they would need adequate time to learn all about the social media platform and could be disadvantaged if they had a weakness or lack of experience in using Twitter. Other PSTs mentioned that such training is important to fast track how to optimise and get the most out of the platform (Table 3). PSTs' privacy concerns revolved around comfort levels in anyone seeing what is posted on the platform and potential plagiarism possibilities from such open access, *"Assessment tasks on Twitter would also be completely open to plagiarism because you can't prove who took it and when and who really owns it."* Some students also felt that such an open and public platform would be more suitable for raising cyber safety awareness *"…I do not think it should be involved in assignments unless for raising awareness of cyber safety."*

Huang's (2002) Instructional Principle for Online Learning in Adults	Theme	Quote
Facilitating Learning	**Assessment Potential**	*"...useful to engage with the different topics according to HPE. For example, finding resources used for different pedagogical models such as cooperative learning, game sense, sport education and so forth."*
		"...online formative tasks are a great method. This could perhaps have some small weighting to equip students for such a global and modern communicative tool."
	Making Things Interesting	*"We did one semester with Twitter tasks for our online tasks rather than the discussion board and it made things more interesting than simply the blackboard discussion board system."*
		"So great to have up-to-date resources readily available- continuing education keeps motivation."
High Quality Learning	**International Insight**	*"An example might be we are doing some work on international games. I could do a search maybe on Denmark what games they get into there and then I have some ideas to work with."*
		"...class size grows dramatically, as students can be exposed to a range of ideas, information and opinions from others outside their traditional classroom into a class of global regions where people are linked by a common interest or set of information and ideas."
Interactive Learning	**Modelling**	*"Looking at how HPE role models conduct themselves and the barriers and facilitators that they experience can raise awareness of how I can get better as a teacher."*
		"...the student could follow say, for example, Dr Libby Weaver, and obtain constant updates and information from her as a health professional which are cutting edge and go beyond the information available in her books."
Learner-Centred Learning	**Access**	*"I probably wouldn't look at it much on placement, but could get some quick ideas or feedback on my ideas by posting with a hashtag. That would be a quick way to get information actually."*
		"Twitter is a professional smorgasboard and I would describe it as a 'modern library'. You can search for posts on a topic, posts from an event, key names that post etc."

Table 2: A sample of themed quotes from the pre-service teachers relating to the perceived facilitators to using Twitter during physical education teacher education.

Discussion

It is important to investigate the perceptions of PSTs that are learning HPE teaching practices (McMahon & Dinan Thompson, 2014; Haynes et al., 2016; Hyndman, 2017b). The present study addresses a gap in the international literature by providing insight into PSTs' perceptions of the potential of using contemporary social media platform Twitter during their H-PETE training. By unearthing the multiple constructivist principles for adult online learners, the study has unearthed possibilities and considerations for a platform within H-PETE programs. It was discovered through our analyses of the data that the PSTs' responses aligned with Huang's (2002) six constructivist principles. Themes generated from the survey findings revealed that PSTs believe Twitter could be valuable during H-PETE to facilitate information access, application to learning, assessment, to engage with technology, capture international insight, keep up-to-date and for enhanced collaboration and communication. Despite such potential for using Twitter during H-PETE training, there were also a number of concerns from the PSTs that will need to be addressed during any future Twitter provisions. PSTs had concerns relating to having adequate training with Twitter, the application to varying educational contexts beyond higher education, privacy in such a public environment, concerns of the excess technology use (especially in such a practical subject) and concerns relating to knowing the purpose of using Twitter and its alignment to HPE classroom practices. The findings from the study can provide some early guidance to universities as to whether improving digital learning in the Twitter social media space can be an important inclusion for H-PETE providers both now and into the future.

The most prominent online learning principle generated from the PSTs' open-ended survey responses was for the Principle 'Authentic Learning' with a number of themes including Twitter having an 'application to learning', providing 'engagement with technology platforms', 'keeping up-to-date' and 'professional development'. Research has indicated that professional connections on Twitter are important to gain insight into specialised topics and to determine how to translate particular teaching practices to their own classes (Britt & Paulus, 2016; Davis, 2013; Erwin, 2016; van Dijck, 2011; Wesely, 2013). Many of the themes in the present study related to Authentic Learning (e.g. application to learning, keeping up-to-date, professional development) were positive with an expectation that Twitter could be a place in which PSTs could develop their own pathways to professional development from supportive professional networks (Armour & Yelling, 2007; Parker & Patton, 2016). It has also been revealed that PSTs learning H-PETE perceive professional development opportunities and keeping in touch with the latest in the profession

Huang's (2002) Instructional Principle for Online Learning in Adults	Theme	Quote
Authentic Learning	Educational Context	*"...Definitely more suitable in more mature groups in teacher training, but would avoid in primary/secondary schools."* *"Negatively- can become immersed in it and forget what you are actually researching!"*
	Excess Use of Technology	*"I don't believe twitter would be beneficial to the classroom. It's just another platform for students to sidetrack themselves from real classroom activities."* *"Negativity. It's just another cyber space forum that is completely unneeded. Students have enough cyber space forums in their life and school without introducing another one. It's just unnecessary."*
	Purpose of Platform	*"Perhaps if there are some really high profile HPE professionals to follow. Yet it is hard to think of Twitter getting students physically fit."* *"I'm not sure how something like social media can get students active? Isn't twitter simply people posting short posts about different thoughts?"*
Facilitating Learning	Adequate Twitter Training	*"...the thought of having to learn how to use Twitter first would be a little overwhelming. I feel it would disadvantage aspects of my own learning due to not being competent with the social media...maybe including a workshop to learn how to use Twitter would be beneficial."* *"Maybe some insight before using Twitter to make sure students using it are aware of any public aspects or that they are posting or interacting in a public space."*
	Privacy	*"...concern I have would be that Twitter would be in a public space a lot of the time and students have to be comfortable with that."* *"I don't want anyone anywhere in the world to know who I am and what I'm doing."*
Interactive Learning	Knowledge of the Twitter Platform	*"Maybe some insight before using Twitter to make sure students using it are aware of any public aspects or that they are posting or interacting in a public space."* *"From my understanding Twitter only allows the use of so many words on each post, I cannot see how this would be beneficial to students' learning or their literacy skills?"*

Table 3: A sample of themed quotes from the pre-service teachers relating to the perceived barriers to using Twitter during physical education teacher education.

to be important for their future careers (Hyndman, 2017b). Many PSTs can approach learning with a 'surface approach' (Entwistle & Tait, 1990; Gow & Kember, 1990; Marton & Booth, 1997; Pill et al., 2012) which can leave knowledge gaps that require addressing (Hyndman, 2017b). A strong content knowledge is vital to facilitate effective outcomes in HPE (Horsley, 2012) and many PSTs have concerns about H-PETE knowledge gaps alongside developing new HPE teaching ideas (Hyndman, 2017b). Health statistics, developing knowledge of HPE ideas, anatomy/physiology and technology have been found to be key areas PSTs are requiring professional development (Hyndman, 2017b). These professional development opportunities are important for future teachers, as acquiring a catalogue of ideas to deliver quality HPE classes ensures classroom students' learning is optimally catered for (Stronge et al., 2011; Pill, Harvey & Hyndman, 2017). Lynch (2013) also suggests research is required to ascertain the proportion of time PSTs receive for HPE development during teacher education studies. The present study demonstrates that Twitter could be a modern solution to alleviating such perceived barriers in PSTs by accessing professional development in an accessible format.

PSTs perceived Twitter could be beneficial for HPE training via the online learning Principle 'Collaborative Learning' with themes including 'enhanced communication and collaboration' alongside the development of 'professional connections'. The PSTs' perceptions of the potential of Twitter to be used in H-PETE for collaboration, communication and professional connection aligns with research of in-service teachers (Harvey & Hyndman, 2018). Twitter has been recognised as a powerful platform to connect with discipline leaders, for professional communication, discuss conferences (Kimmons & Veletsianos, 2016) and advocate (Robson, 2017). With teaching isolation being a continued problem (Lortie, 1975), such communication solutions to connect with a broad range of international educators is important. By PSTs connecting with a broad range of international educators this could also ensure PSTs are developing more authentic learning experiences (Lombardi, 2007). This suggests Huang's constructivist framework can meet more than one online learning principle for adults. The PSTs also perceived through the Principle 'Interactive Learning' that modelling from other industry leaders could be possible through using the Twitter platform during H-PETE. There are many effective educators out there, but literature suggests that Twitter users should show caution in whether what is posted is truly representative of their teaching situations (Gleddie et al., 2017). Gleddie and colleagues (2017) note that on Twitter people can paint a picture of themselves that is not accurate through sharing success rather than difficulties.

The 'Learner-Centred' Principle theme in the present study was based around PSTs' perceptions of the ability to 'access' information through Twitter for H-PETE. Twitter has previously been reported to be useful in that the platform can side-track a number of time and financial requirements associated with more formalised professional development (Goodyear et al., 2014). With the many additional work demands on PSTs (Hyndman, 2017b), the ability to have time built into a working day for professional development is important (Wei et al., 2010). As teachers can be challenged to integrate digital technologies in pedagogically effective ways by going beyond surface stages of technology use (Gleddie et al., 2017), convenient access to professional development in our modern classrooms is as important as ever. Yet it should be acknowledged that Twitter should not be dictated to PSTs (Calderon et al., 2017) and there needs to be a shared sense of purpose between the learners and their H-PETE conveners. For those who have not been exposed to Twitter before, it was clear in the study that some PSTs require greater clarification of the purpose of its use to determine its functionality. A recent study of international HPE Twitter users (Harvey & Hyndman, 2018) discovered that PE professionals perceive the Twitter platform to have strong value for connecting with others, learning about PE and sharing ideas conveniently. Further insight for

PSTs into such functionality could provide valuable insight into the potential learning purposes of Twitter. Nonetheless, it was important in the current study not to pre-empt Twitter learning possibilities to ensure such insight did not sway results and to ensure PSTs perceptions were natural and not influenced by data.

In contrast to Harvey and Hyndman's (2018) findings that more experienced PE professionals' Twitter use has resulted in a wide range of positive benefits, the PSTs in the study perceived a number of concerns. Despite a significant digital movement in education over the past decade and moving content online (Collins & Halverson, 2009), PSTs shared concerns about introducing too much use of technology. Balancing the provision of more traditional (non-digital) approaches with digital approaches in education continues to be a major challenge for teachers (Ross, Morrison & Lowther, 2010). As noted earlier, many of the concerns of using Twitter could be eradicated by detailing to PSTs the potential functionality of the platform for learning, yet another major concern was 'privacy'. Some PSTs in the present study did not want other people to be able to see their online interactions and thought that plagiarism could also be an issue from posting on a public platform. Similar to previous social media research, students do not always feel safe or comfortable in online spaces (Karahasanovic et al., 2009). Although many of Huang's online learning principles for adults were met, it has been established that internet and privacy safety can be major concerns in web 2.0 social learning contexts (Hughes-Roberts & Kani-Zabihi, 2014; Aymerich-Franch & Fedele, 2014). In order for learning to be optimised in web 2.0 contexts, students must feel comfortable, safe and secure (Aymerich-Franch & Fedele, 2014) which can make Twitter's public domain daunting for some. Ensuring PSTs are aware of privacy concerns, prepared adequately for the platform and understand key Twitter functionality for learning can ensure PSTs can optimise their learning through Twitter's learner-centred, and open dialogue nature. PSTs can then be critically reflective on how to manage interacting in a public forum and user/organisational posts for future, potential teaching application. Further research into how tertiary educators are trained in facilitating PSTs' social media use is an area warranting further investigation.

There are a number of strengths to this study. The research was the first empirically-based scoping of PSTs' perception of the potential of using Twitter during H-PETE training. The qualitative nature of the study allowed the researchers to gain a depth of insight into the facilitators and barriers to PSTs using Twitter during HPE. Although it should be acknowledged that the integration of further study methods (e.g. interviews and focus groups) may have generated further insights to those gained in the current study, the responses of the Australian PSTs yielded a broad range of perceptions to possible facilitators and barriers to using the Twitter platform. The study was underpinned by a constructivist theoretical framework for adult online learners to assess suitability of the platform to meet the key principles of online learning. Moreover, the findings from this current study provide incentive for further research to explore PSTs' perceptions of using Twitter and/or other forms of social media within H-PETE studies. Further replicative work with a larger, more diverse sample can enhance the generalisability of the findings to other settings (Hill, 1998; Makel & Plucker, 2014). The timing of surveying students should also be considered to recruit further participants, as many PSTs could be committed to finalising studies (e.g. examinations, final assignments) or undertaking placements towards the end of a semester. While this present study provides a foundational Twitter exploration in the field of H-PETE research underpinned by the Huang's (2002) instructional principles for online learning in adults, further research is warranted.

With ever-increasing demands within school systems, PSTs must progressively develop their readiness and preparedness for the delivery of practical subjects such as HPE. By developing exploratory insight into what the facilitators and barriers are for Australian

PSTs to using Twitter within H-PETE studies, teacher education programs can reflect upon such findings and consider methods to optimise their online learning environments to address the needs of our future HPE teachers. While addressing all perceptions perceived by the PSTs through H-PETE training may not always be possible, promoting awareness of the broad themes from this research can further ensure the potential or cautions associated with Twitter can be addressed to develop improved online teaching confidence for HPE learners in the future.

Conclusion

This is the first study to the authors' knowledge to directly investigate Australian PSTs' perceptions of using the Twitter social media platform during H-PETE training, underpinned by a constructivist framework for online learning. It was revealed within the study that PSTs perceived a myriad of facilitators across the constructivist principles that included authentic learning, collaborative learning, facilitating learning, high quality learning, interactive learning and learner-centred learning. The current Twitter study results also reveal a number of potential barriers and concerns such as excess technology, privacy, the purpose of the platform and how Twitter would be used beyond higher education. As technology is now a major part of the modern lifestyle and learning landscape, teachers must be critically reflective on Twitter's appropriateness for their own professional learning and application to students' learning within HPE classes. Unpacking PSTs' perceptions of the potential of Twitter within H-PETE can contribute to the pedagogical decisions made by teacher educators to improve social media uptake in PSTs.

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