Social media and teacher professional learning communities

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Abstract

Background: An extensive and international evidence base positions professional learning communities (PLCs) as an effective continued professional development (CPD) mechanism that can impact on teachers' practices and, in turn, students' learning. The landscape of teacher PLCs is continuously developing; notably through teachers' uses of social media. Yet, there is limited robust evidence identifying the characteristics of social media PLCs that impact on teachers' learning and practice.

Purpose: This exploratory study examined the characteristics of a specific Twitter-based professional learning community - #pechat. The research questions were: (i) what is the nature of a Twitter-based professional learning community? and (ii) what characteristics of a Twitter-based professional learning community develop learning and practice?

Methods: Data were generated from 901 tweets between 100 participants; and 18 in-depth semi-structured elicitation interviews with participants and moderators of the Twitter-based professional learning community. Data were analysed through a process of deliberation, and a relativist approach informed quality.

Findings: Two themes are reported to explain the nature of the Twitter-based professional learning community and the different types of characteristics of #pechat that developed learning and practice. The first theme *engagement* shows how different participants of #pechat engaged with discussions and how moderators played a key role in facilitating discussions between participants. The second theme *shared practices* shows how discussions between participants of #pechat led to the development of new practices that some teachers were able to use to accomplish particular objectives in their physical education lessons.

Conclusion: The analysis of the data provided evidence to suggest that #pechat is a PLC and is representative of an established group of practitioners. These characteristics should be considered in the design of future online professional development experiences. Facilitator or moderator training could support the development of social media based PLCs that subsequently and positively impact on teachers' practices.

Keywords: communities of practice; professional learning; constructivism; situated learning

66 It is extensively agreed that teacher professional development (PD) is an essential mechanism
67 through which to enhance the quality of teaching and, in turn, improve students' learning
68 outcomes (Armour et al. 2017; Sato and Haegele 2017). Yet, for a number of decades it has
69 been reported from diverse international and socio-economic contexts that physical education
70 teachers are rarely able to access and engage with effective PD, with time, cost, and a lack of
71 access to relevant content frequently cited as key barriers (Parker and Patton 2017,
72 Makopoulou 2017). As a result, there are concerns about teaching quality and whether
73 classroom practices are evidence-based (Armour et al. 2017, Sato and Haegele 2017). The
74 enduring issue of effective teacher PD is coupled with the ongoing marginalisation of the
75 subject (Pope, 2011, masked for peer review). For example, cuts to the time devoted to the
76 development of subject knowledge in graduate physical education teacher education
77 programs are becoming commonplace (Dudley and Burden 2019), alongside the reduction of
78 physical education teacher education programmes in leading international institutions[1],[2].
79 This means that, across physical education teachers' careers, opportunities to learn and
80 develop their practices are becoming increasingly limited. The creation of new PD practices
81 that support teachers' learning needs, and navigate contextual barriers to PD, are therefore
82 vital for teachers and for those researching physical education.

83 Social media has been reported as an increasingly 'popular' digital/online context
84 used by teachers for PD purposes (see Greenhow et al. 2018, Greenhow and Lewin 2016).
85 There is evidence that teachers use a range of different social media sites - such as Twitter,
86 Facebook and YouTube - to post and exchange pictures, resources and information
87 (Greenhow et al. 2018, Harvey and Hyndman 2018). Furthermore, teachers are reported to be
88 forming communities on social media, and engaging in social-media based chats to share

[1] https://www.thelantern.com/2018/02/physical-education-teacher-education-program-to-be-phased-out-by-2022/;
[2] [MASKED FOR PEER REVIEW]

89 information about their practices (Krukta and Carpenter 2016, Trust et al. 2016, Wesley
90 2013). Yet, there is limited robust evidence on the types of content, interactions and spaces
91 that support teachers' learning and practices (Britt and Paulus 2016, Carpenter and Krukta
92 2016, Krukta and Carpenter 2016). Despite almost a decade of research on social media and
93 teacher PD (Greenhow et al. 2018), the primary empirical focus has been on why teachers
94 engage with social media for PD (Britt and Paulus 2016, Carpenter and Krutka 2015, 2014,
95 Harvey and Hyndman 2018). There is very limited understanding about how *teacher learning*
96 occurs via social media and how social media operates as a form of PD that impacts on
97 practice.

98 The purpose of this paper is to examine social media as a contemporary form of
99 teacher PD. The specific focus is on better understanding how teachers' engagement with
100 social media develops their learning and practice(s). The article reports on a case study of a
101 Twitter-based physical education chat - #pechat - and presents new data from over 100
102 international participants. The concept of professional learning communities (PLCs) is
103 applied to explain the social media-based learning context(s). The research questions were:
104 (i) what is the nature of a Twitter-based professional learning community and (ii) what
105 characteristics inherent within that professional learning community develop learning and
106 practice?
107

108 **Professional Learning Communities**

109 An extensive evidence-base reports on how the concept of PLCs can be applied to assist in
110 explaining the architecture of learning environments in group or community-based contexts
111 (Parker et al. 2012, MacPhail et al. 2014). PLCs are generally referred to as groups involving
112 members who share common learning/professional interests, in which interactions and
113 discourse take place over time through discussion, analysis and problem solving, that result in

114 professional learning (MacPhail et al. 2014, Parker et al. 2012). The conceptual framework of
115 PLCs was, therefore, highly relevant the social media-based context of a bi-monthly Twitter
116 chat, and was applied as an analytical framework for this study.

117 An international literature base has sought to define and establish different types of
118 characteristics of PLCs (see Author 2015, Armour et al. 2017, Parker and Patton 2017, Yoon
119 & Armour 2017). Parker et al. (2012) identified three broad types of PLCs: (i) collections of
120 authentic teachers, (ii) established groups, and (iii) communities of practice (CoP) (see Table
121 1). These different types of PLCs are defined by five characteristics with differing features:
122 (i) success; (ii) guideposts; (iii) facilitator; (iv) roadblocks; and (v) potential (see Table 1).
123 The main differences between these five characteristics is the collaborative and co-
124 constructed nature of how individuals work together in groups. For example, whereas in the
125 collection of authentic teachers' success is determined at an individual level, in a community
126 of practice (CoP) success is integrated amongst the practices of group members (Table 1).
127 Parker et al. (2012), and later MacPhail et al. (2014), argued that the more groups adhered to
128 the constructs of CoPs deeper learning, more focussed the direction of learning, and stronger
129 growth in teachers and the community would be evident. The characteristics of CoPs can
130 therefore be used as aspirational criteria for the design of effective professional development
131 (MacPhail et al., 2014; Parker et al., 2012). In that context, we explain CoPs in a bit more
132 detail.

133 CoPs are grounded within situated learning perspectives (Parker et al., 2010). A CoP
134 can be summarized as 'groups of people who share a concern or a passion for something they
135 do and learn how to do it better as they interact regularly' (Wenger and Wenger-Traynor
136 2015, 1). CoPs are not haphazard groups (Lave and Wenger 1991). Groups evolve as
137 members come and go and as old members leave and new ones join. Lave and Wenger's
138 (1991) notion of legitimate peripheral participation can be used to describe how newcomers

become fully participating community members. When members are new, learning is not so much seen as knowledge acquisition as it is more of a process of social engagement as learners 'move toward full participation in the socio-cultural practices of a community' (Smith 2009, no page). During legitimate peripheral participation, newcomers begin their participation by engaging in activities that may appear simple, yet, are necessary for the group. Through these peripheral activities, novices become acquainted with the tasks, vocabulary, and organising principles of the community. In this phase there 'is a concern with identity, with learning to speak, act, and improvise in ways that make sense in the community' (Smith 2009, no page). In essence, 'learning to talk the language of the community' is foundational to legitimate peripheral participation (Lave and Wenger 1991) and is representative of the process of newcomers.

Methods

A case study design was adopted to provide rich and in-depth insights into teachers' engagement the Twitter-based chat, #pechat (Hodge and Sharpe 2016). An iterative design was adopted to provide both breadth and depth in the data generation process.

Site and Context

The site of this study is Twitter and the context of Twitter that we explore is the #pechat group. Twitter is a free micro-blogging site where members can post messages in the form of tweets. At the time of the study, tweets were restricted to 140 characters but these could include text, pictures and/or links to other websites. Various other functions are available that enable Twitter users to share or view information with specific people and view or engage with discussions with groups of Twitter members (Table 2). Hashtags can be embedded within tweets and are used to signify a specific topic, a group of people, or to tweet within a Twitter chat group. Twitter members can create their own hashtags or search

for specific hashtags commonly used. When Twitter members search or use common hashtags they can view other tweets about the specific topic (for example, #physed), they can engage with a specific group of people (for example, #pegeeks), or they can engage with a Twitter-based chat (for example, #pechat). Importantly, a Twitter user does not have to tweet to view the posts that are made using the hashtag.

[Insert Table 2 here]

#pechat is a Twitter based chat forum that uses the same hashtag for Twitter users to engage in discussions. #pechat was founded in 2011 by a physical education teacher who was also the founder of a professional development website (www.thephysicaleducator.com) that is linked to and used to promote #pechat. At the time of the study #pechat (which had been running for approximately three years) was hosted bi-monthly and occurred at 7pm across five international time zones (Australian Eastern Time, Singapore Time, Greenwich Mean Time, Eastern Standard Time, Pacific Standard Time) on a Monday evening. Each #pechat was based around a specific topic with pre-defined questions for contributors to answer. The topics and questions were usually selected by the founder of #pechat and were generated through polls hosted on the website and shared through Twitter.

For each of the five #pechat's a moderator was assigned; one for each of the time zones. The moderator's role was to tweet the pre-defined questions and to guide the discussions by asking questions and prompting users to share their perspectives.

Data Generation

Data were generated from two sources: Twitter and interviews. The contextual focus was on five different international #pechats that took place on the same day in March 2014. The broad topic of the #pechat was 'a cry for help' and was focussed on how practitioners could help other teachers to develop and change their practices. The moderators were provided with a series of questions to guide discussions.

First, similar to the approach adopted by Author (2017), data were generated from tweets made during the five chats using the application Twitonomy[3]. The aim of generating data from Twitter was to provide an illustrative example of the types of interactions within the Twitter chat. The hashtag #pechat was used to search for and gather tweets. Data from Twitonomy were exported to an Excel file and the participants and the content of each participant's tweets were identified. Across the five #pechat's a total of 901 tweets were made by 100 different people. The tweets generated informed the selection of participants for interviews and the content of interview questions, and the tweets were later combined with the interview data during analysis. The tweets therefore provided an additional layer of rigor in this study. Methodologically, the tweets directed and maximised the focus on the relationship between social media and teacher learning. Empirically, the tweets strengthened the robustness of the findings, where evidence is reported from real time (tweets) and retrospective data (interviews) (Author 2017).

Secondly, data were also generated from 18 individual interviews, that took place following the #pechat. The aim of generating data from interviews was to interpret how the participants engaged with the #pechat, and how they had engaged with #pechat over time (i.e. beyond the specific chat in March 2014). A purposeful sampling approach was adopted using a criterion-based technique (Sparkes and Smith 2014). This approach was selected to ensure that the participants of this study were representative of range of #pechat participants, but that had all participated in #pechat over a period of time. The criteria used was based on different intensities of engagement, in terms of participants' role in #pechat and the number of tweets participants made. Following this approach, a sample of 18 was considered to provide a level of rigor (Sparkes and Smith 2014). The sample selected included; (a) moderators (n=4) and (b) participants (n=14) who engaged with the #pechat at high (50 or more tweets), moderate-

[3] www.twitonomy.com/

high (20 or more tweets) and low (less than 10 tweets) levels. The criterion sampling approach also sought to ensure an appropriate balance in gender and geographical location (see Table 3).

The interview process was initially informed by an elicitation approach to provide depth in the participant responses through the use of text-based data to trigger responses and memories (Phenoix and Rich 2016). Participants were asked to read the tweets they made during the #pechat and then discuss their interpretations of these. Following this, questions were asked in a semi-structured format about how #pechat had supported their engagement and learning. Each interview was conducted via Skype and lasted between 45-60 minutes.

[Insert Table 3 here]

Ethics

Ethical approval was provided by the Institutional Review Board and Twitter's terms of service were consulted prior to data generation. Passive consent was sought from participants to access tweets made during the #pechats. Passive consent occurred via an information statement posted by the moderators and the first and third author prior to, during, and at the end of each #pechat. The statement was also posted to one of the author's website. The information statement informed participants that tweets made during the #pechat could be used for research and participants' names and specific tweets could be used in the reporting of the findings. Given the public nature of Twitter, the traceability of tweets and, subsequently, the limited effectiveness of de-identification processes in social media research (see Author 2017), anonymization strategies were not employed in the writing of this paper. The information sheet, however, did state that participants had the right to contact the research team via Twitter or email if they did not want their name or tweets to be used in the reporting of the findings. None of the participants of #pechat contacted the research team and in the reporting of the data from Twitter participants first names are used to represent their

Twitter handle (e.g., @Adam) and tweets presented verbatim. Active consent and anonymity procedures were followed for data generated from interviews. Participants provided written informed consent and participants were de-identified from the interview transcripts, due to the sensitivity and confidentiality of some of the information they shared.

Data Analysis

The characteristics of PLC's identified by MacPhail et al. (2014) and Parker et al. (2012) (see Table 3) were used to analyse the data. Following this framework, the authors were guided by concepts of success, guideposts, facilitator, roadblocks and potential, where analytical questions derived from the framework were deliberated, decided upon and used by the authors. This process ensured that the research questions remained a central focus while also remaining open and reasonable to emerging understandings. The analytical questions constructed and utilised were: (i) what is the nature of success, guideposts, facilitator, roadblocks and potential in #pechat; and (ii) how does success, guideposts, facilitator, roadblocks and potential support and develop learning and practice?

The first analytical step involved the organisation of the Twitter data. In order to interpret ongoing discussions between participants and groups of participants, tweets and conversations were grouped by; (i) separate #pechat's, (ii) singular tweets, and (iii) conversations, that involved a series of two or more tweets. The second step of analysis was informed by the analytical questions. A deliberative strategy was used, inspired by Tracey's (2010) end goals for excellent qualitative research, as well as the work of Englund (2006) and Author (2017). The analytical questions were used by the researchers to independently analyse the data. Each researcher formulated codes and themes, and these became the basis for deliberation between all three authors. The aim was to ensure that themes represented something 'in common' (Author 2017, p. X) about the answers to the analytical questions. The deliberative process resulted in two themes: (i) engagement and (ii) moderation.

Validity

A relativist approach was applied to inform validity and determine quality (Burke 2016). A relativist approach extends the robustness of traditional measures of quality drawn from criteriological approaches (Burke 2016), such as trustworthiness, as it offers a framework for determining quality in a way that aligns with the contextual circumstances of the study. In applying a relativist approach and, following the work of Smith and McGannon (2017), universal criteria for judging the quality of research are not applied (e.g. dependability, confirmability). Instead, criteria are selected from an ongoing list of characterising traits that relate to the context of the research (Smith and McGannonn 2017). The following criteria were selected as representations of quality and validity within this research: the worthiness of the topic; the significant contribution of the work; width, that is, the comprehensiveness of evidence and the use of multiple and numerous data sources from a wide sample of participants (n=100); and credibility through the first and third authors' familiarity with the #pechat group, as well as the rigorous analytical process involving deliberation. As part of a list of characterising traits for enhancing the quality of this work, this study also aimed for coherence. In other words, how well the study hung together in terms of purpose, methods and results, as well as its strong underpinning of theory, i.e. PLCs through CoPs. Evidence of quality and validity in this study are therefore aligned with the contextual circumstances of the research.

Results

Two themes represent the nature of the Twitter-based professional learning community and the different types of characteristics of #pechat that developed learning and practice: (i) *engagement* and (ii) *shared practices*.

Engagement

Two overarching and contrasting forms of engagement were identified: *active* and *observational. Active* engagement was associated with participants of #pechat who held an identity as a "big name on Twitter" (participant 1 interview). *Observational* engagement was associated with participants who were referred to as lurkers.

The "big names on Twitter" were those who were identified as being "active in social media" (participant 1 interview) and were often the high or mid tweeters and/or the moderators (Table 2). The big names shared firm and dominant views and were individuals who other participants attempted to connect with through replies, retweets (RTs) or favourites (see Table 1). For example:

Adam:	Activities and learning opportunities are differentiated for readiness level. Students can choose within that framework #pechat
Naomi:	RT
Andy:	@Adam Amen! #pechat
Naomi:	@Adam Agree!... That was well said! #pechat (tweets)

High levels of connectivity with the big names was associated with these participants having "something worthwhile to say" (participant 2 interview). The high levels of interactivity were also associated with the number of tweets sent by the big names. Most of the big names tweeted in more than one of the five #pechat's. For example, Andy, who made a total of 65 tweets during the five #pechat's, tweeted his opinion on a particular topic more than once. For example, he re-shared his views from the Singapore chat in the Canada chat,: 'as I said in last night's chat, she's taking responsibility which is great I think. Not so much blaming herself #pechat' (tweet).

Despite the "big names'" connectivity being associated with a valued voice and opinion, it was acknowledged that others connected with them because they "think that it is the right thing to do" (moderator 1 interview). The big names held a certain identity within the #pechat community and were described as "those types of people that will say something and people will buy into it right away" (participant 3 interview). This identity, however, was

not only attributed to the number of tweets, knowledge, or confidence. The big names were described as being white males that was perceived to provide them with a certain privilege for their voice to be heard: "It's a certain gender, it's a certain ethnicity, so it's an interesting question because some voices are heard based on our privilege and based on who we are" (participant 4 interview). The data indicate that the nature of the learning was shaped by positions of power and influence.

At the other end of the engagement spectrum were participants identified as "lurkers" (participant 5 interview). Lurking involved observing tweets and commenting only when something was interesting or engaging.

> I'm basically a lurker…. So I look at everyone's ideas, like whenever I have downtime I'm on Twitter I'm scrolling through the hashtags seeing what people are saying and then if I see something that's like really really cool or really inspiring I'll comment on it. (participant 6 interview)

The reason for lurking was often associated with participants feeling like they did not have something worthy to contribute. For example, "I don't feel like I have much to add to or I'll listen but I won't add to things so I'll just lurk a little bit!" (participant 5 interview). Lurkers averaged between one and three tweets (Table 2) and rather than sharing opinions, their tweets often involved asking questions: "how do I give choice to some while still maintaining structure for others in the same class #pechat" (Joe, tweet).

Despite a number of participants suggesting that they or others lurked, lurking wasn't seen as a problem. For example, one lurker was quite open to the #pechat group that he/she had lurked and tweeted, "enjoyed lurking and following along - good discussion all" (coachdeneef, tweet). For the more active users of Twitter, lurking was an accepted form of engagement because it was positioned as a way of helping Twitter members to learn about Twitter, what to tweet, and with whom to interact. In other words, it was a form of apprenticeship or work-place learning. Lurking was seen as a process that would enable people to develop their own professional learning network:

> You get on, you lurk, you have to find people, you have to find groups to follow topics to follow and you lurk and you read and you know ... then all of a sudden you like something. You favourite something, you retweet something and then comes your big ... you know either a reply to somebody else cos I think that's what I did first, I post somebody ... sent ... reply…that's an awesome idea so that was the first thing I wrote. And then from there it was kind of like, ok so I'm gonna put something out there, you kind of put your feelers out there and your PLN [Professional Learning Network] grows. (participant 7 interview)

The mid tweeters' engagement in #pechat contributed to the momentum of discussion. These participants' engagement might best be described as sharers. The mid tweeters would often respond to a moderator's question by sharing their opinions or by providing examples from their own practices. The mid-tweeters would ask questions and interact with others during #pechat to understand how they could do particular practices others had shared. Nicholas asked Adam and Andy (both high tweeters) to explain how he could use the ideas they had shared in lessons; '@Andy @Adam I only see my 4-6gr. [grade] classes 30 times in #physed during the year…how do I learn what motivates my S's [students] #pechat' (Nicholas, tweet).

Regardless of the form of engagement it seemed that moderators played a key role in facilitating the different types of participants' engagement. Moderators described their role as being about "trying to get people involved… guiding discussions" (moderator 2 interview). For some moderators this meant ensuring that all participants knew how to engage in #pechat. The moderators would do this by RTing the pre-determined questions for the #pechat or RTing the @physical.educator.com's tweet on how to engage with #pechat: "RT @phys_educator: Not sure how #pechat works? Want to join in the discussion? Check out our #pechat 101 video here: [link to website removed]" (tweet). During the chats the moderators posed the topic questions but they also aimed to respond to and develop the discussions. One moderator spoke of how she aimed to "try to put myself in their shoes to continue to explain…I try to make them feel emotionally safe" (moderator 3 interview). This

moderator acknowledged that there were different types of practitioners involved in the discussions who had different experiences and levels of knowledge.

> Sometimes people ask a question and I feel like doh you don't have that foundational piece, but those are the people I want to support and encourage the most. I am not sure that everybody feels that way. Tone can sometimes get lost, I am the person that would rather take five tweets to make sure my tone is clear as opposed to the someone who might take one and not worry about that (moderator 3 interview)

The moderator's role was also seen as being about creating discussions (i.e. a series of tweets) and encouraging participants to move beyond solitary statements (i.e. one tweet). As one moderator commented, he needed to question participants as a means for them to describe and discuss their practices in further detail:

> Often people will respond with a pretty closed response. I guess the role of the moderator is to question that again and say ok well why, how or when would you do this rather than just accepting that, otherwise you end up with, well its not really a conversation its just a series of statements (moderator 1 interview).

In summary, two predominant forms of engagement and types of practitioners existed within #pechat; active engagement (big names) and observational engagement (lurkers). The mid tweeters, known as 'sharers', supported the momentum of discussion and the moderators played a key role in encouraging practitioners to share practices.

Shared Practices

Shared practices refers to how participants generated new understandings, new ideas, and new practices that could be transferred into their lessons. While #pechat was described as a form of PD, #pechat discussions did not support all participants learning or practices.

Most of the discussions in #pechat involved sharing practices around the pre-defined topic. Many of the tweets were focused on offering different ways of doing similar things. These types of tweets were described as being useful to practitioners as they could gain different ideas that they could transfer into lessons.

> Naomi: we use e-portfolios in our school & have video and pics #pechat
> Tish: videos, blogs, go to school board, NP anything to highlight #pechat

Jennifer: I use @socrative to get info. Kids use phones. Took abt 15 min and gave me great data to use #pechat (tweets)

I have an idea or an opinion and so often somebody adds extra value to that or brings that different perspective that I hadn't thought of, you know, for context and it's like… fantastic I'm gonna try that. (participant 8 interview)

Participants did not always agree on all practices. The moderator was positioned as someone who would "make the boat rock a bit" (participant 9 interview) and encourage participants to question their own or each other's beliefs and/or practices.

He was playing devil's advocate sometimes, to expand your thinking and kind of take the opposite side, whether they agree with it or not. (participant 9 interview)

The following series of tweets provides an example of how the moderator would "play devil's advocate" (participant 9 interview). The tweet discussion begins with a participant sharing the idea of students developing their own games (tweet 1). The moderator challenged the participants by asking them to explain the learning environment (tweet 3) and by then suggesting that students developing games is a messy process (tweet 5). Tweet 7 invited other participants into the discussion but the moderator continued to challenge the participants by raising issues of Moderate to Vigorous Physical Activity (MVPA) (tweet 6). As the discussion continued (tweets 8 - 13), the participants expanded on the original point about students developing games and began to discuss how lessons could be structured to accommodate MVPA. The tweet discussion continued beyond the 13th tweet used as in the illustration below, but as the 13th tweet indicates, after the moderator had "rocked the boat" (tweet 5 and tweet 6) the moderator began to agree with the suggestions for practice made by the participants.

Tweet 1: (Matt): @Moderator @Nicholas hand the group a bag of equipment. Let them develop the game. Also, use 7 parts of the game as guide #pechat

Tweet 2: (Nicholas): limited opportunities for creativity within their educational experience. Expecting more rules/guidelines from me #pechat

Tweet 3: (Moderator): @Nicolas so how can you create a culture of learning that embraces the opposite

Tweet 4: (Matt): kids set own goals. They are becoming self-motivated to learn and move #pechat
Tweet 5: (Moderator): @Nicholas @Matt I do have personal bias against this idea. Same with peer teaching. Always messy #pechat
Tweet 6: (Moderator): @Nicholas @ Matt and always loses tons of MVPA….
Tweet 7: (Andy): @Nicolas @Matt @Moderator LEARNING IS MESSY YAHOOO!! #pechat
Tweet 8: (Moderator): @Nicholas @Matt @Andy hah! I am absolutely ok with messiness – IF there is a purpose behind it #pechat
Tweet 9: (Andy): @Nicholas @Matt @Moderator it also doesn't have to loose MVPA when done well
Tweet 10: (Nicholas) @Matt @Moderator @Andy Students HR's during class today over 150. Their games = more passion! Creating thinkers, not just doers! #pechat
Tweet 11: (Andy) @Matt @Moderator @Nicholas so you give them a goal to get HR 150+ for majority of the time, get them monitoring it #pechat
Tweet 12: (Matt) @Moderator @Nicolas @Andy set up a goal/focus that toward MVPA. This is an item the teacher can help students develop #pechat
Tweet 13: (Moderator):@Andy @nicholas @Matt I suppose anything will work if done correctly. I am a HUGE believer in peer feedback #pechat

(Twitter conversation)

The ability to engage in a series of tweets where participants offered different perspectives had not always been part of #pechat. The participants described how there had been a shift from resource sharing toward interactions and the development of shared practices; "it started off being all about resources but now it's more about concepts or idea sharing. It's definitely evolved for me" (participant 10 interview). Importantly, there was a distinct difference between learning through using Twitter and engaging with #pechat. The latter made learning associated with collaboration and discussions possible.

> Social media is not professional development. Social media is a platform. Professional development for me is the interactions I have with people. The conversations that I have with people. And the collaboration that it kind of leads to. So PE-Chats – I think if you are engaging in a PE-Chat and you're having conversation – even if you're lurking you're definitely learning something. You're seeing different perspectives for different people. So yes. So I'd say that it's a form of professional learning. (participant 11 interview)

Despite somewhat widespread agreement that #pechat was a form of PD, the growth and popularity of #pechat from its initial introduction had caused some participants to

consider that their learning wasn't always supported. As one participant suggested, "a lot of us who started on it [#pechat] feel that it's too big at this point" (participant 10 interview). Moreover, #pechat was described as being "much more congested" (participant 12 interview):

> By the time you've seen something you'd like to engage with 50 other people have jumped in and taken that part of the conversation away so it's just about impossible to actually keep up (participant 12 interview)

Some individuals were accessing other social media sites and/or developing smaller groups on Twitter. There were other connections forming that were described as "close-knit groups" where participants considered people in these groups as "not just colleagues but friends" (participant 13 interview). The following highlights one participant's engagement with the social media site Voxer and how the community on Voxer enabled her to change and develop her lesson within the same day.

> I got on Voxer and you know, in between classes I'd have five minutes, I got on and said hey, don't know if any of you played this it's a great warm up game bla bla bla so I wasn't even asking for any help… but…in two to three minutes I had two or three other people who got on and who replied with hey I do that but I do a variation like this… And the very next class I switched and I added that. So I have five minutes between classes and within that time period I learned a new variation that incorporated adding math to my lesson and then a grade in other content areas and I mean the kids loved it just the same. (participant 14 interview)

Overall participants of #pechat developed shared practices through their responses to particular questions and/or through the moderator challenging the participants' discussions. Although #pechat was valued as a form of PD, many participants engaged with other social media sites to collaborate with smaller groups of members from #pechat.

Discussion

This exploratory study into a Twitter-based PLC has demonstrated that social media can operate as a form of PD for teachers that develops their learning and practices. There was evidence that observing and/or actively participating in Twitter-based discussions supported teachers to develop new understandings and shared practices. In some cases, practices that

were co-constructed between teachers during Twitter-based discussions transferred into a teacher's lessons demonstrating that social media has the potential to be a very powerful form of contemporary PD that impacts on practice. Yet, the Twitter-based professional learning community did not influence all participants learning and practices. The participants had different learning needs, contexts, knowledge and practices, and they engaged in #pechat in different ways (active, moderate engagement and passive) and to different intensities (high, mid, low tweets). The differences between the participants resulted in variance in how learning was facilitated and structured within #pechat. The challenge for the field of PD is understanding how to support and develop teacher learning in digital spaces when there are mass numbers of participants with different needs and different intensities of engagement.

Identifying the characteristics of the Twitter-based PLC provides a way to determine how learning can be structured and supported on social media. The original contribution of this study is the empirically rich data that identifies the nature of PLC characteristics (i.e. success, guideposts, facilitator, roadblocks and potential – see Table 3), and evidence of how the characteristics that impacted on learning and practice. This study shows that #pechat is an established group. It was evident that there was an accomplished objective of achieving shared practices where individuals, to varying intensities, were empowered to engage with discussions. Furthermore, the data demonstrated that there was continuous interaction between participants, where moderators and mid-level tweeters supported the flow of discussion. The moderators also acted as the role of facilitators, where individuals with higher status on Twitter were also influential. Finally, and in smaller interactional groups, issues were identified and resolved between participants. In this sense, social media was a space that supports professional development in a way that impacts on learning and practice by enabling practitioners to form established groups.

Although the Twitter chat acted as a form of PD, the data demonstrate a number of challenges for practitioners using social media as a PD tool. It should be noted that engagement with Twitter chats does not support all practitioners' learning and practices. Clear challenges were evident with regard to the mass, open and many-to-many forms of communication, where interactions became disconnected and fragmented due to high numbers of participants. To navigate against this issues, social media sites that enable smaller groups of participants to come together in more refined spaces are an option. The data from this study suggests that in such spaces, participants can develop richer professional relations and deeper discussions about practice occur. Due to these capabilities of smaller groups, it can be suggested that these spaces of social media may be more representative of legitimate peripheral participation and the constructs of CoPs. To further develop understandings of the social media as a PD tool, future research should examine the characteristics of these smaller and refined PLCs on social media.

Another challenge was related to influence and self-presentation. The data suggested that individuals with high status can hijack discussions and direct conversations to issues that they deem important, but may not be representative of the whole community. Issues of gender and ethnicity also provided a level of power in relation to PLCs. The role of the facilitator in PLCs is to seek a balance between new concepts with prior experiences and to push teachers at appropriate points in an effort to maximize learning (Poekert 2011). Effective facilitators guide rather than direct, question rather than show the way, and listen rather than tell (Patton & Parker 2014; Parker and Patton 2017), yet have the critical role of managing group dynamics (Molle 2013). Among other things, in order to develop trust and respect, participants should have an equal voice in conversations (Hunuk, Ince and Tannehill 2013) and actions must be taken to equalize opportunities and engagement where a power differential traditionally exists (Patton, Parker and Neutzling, 2012). Armour and Yelling

(2007) described the intricacies of doing this stating that effective, professional development providers 'need to tread a careful line, simultaneously being leaders (providing expert input, helping teachers to work together) and followers' (195). While these issues occur in face-to-face communities, controlling and limiting the domineering behaviours presented in social media environments may be more complex and require even more skill in facilitation. These findings therefore further stress the importance of professional development for facilitators or moderators in social media contexts (Makopoulou, 2017).

Although this study has demonstrated impact, several limitations exist. Firstly, only a small sample of practitioners were interviewed from a broader sample of participants. While the potential for generalizability was addressed, a wider sample could have provided further insights. A second limitation concerns the generation of empirical data from one collective #pechat. To understand the nature and form of a PLC over time, data could be generated from Twitter over a series of #pechats.

Conclusion

Teachers access to, and engagement with high quality, PD has been an enduring issue. Social media can overcome some of the barriers to teacher PD. The findings reported are from a diverse and international sample and provide evidence on how teacher learning occurs via social media, and the characteristics of social media-based groups or communities that influence knowledge and behaviour change. Hence, the findings indicate that social media is a contemporary form of professional development that can address the clear challenges associated with teacher learning and, in turn, enhance the quality of teaching and improve student learning outcomes.

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