RTPE-2018-0142.R2

Insights from ICT expert teachers about the design of educational practice: The learning opportunities of social media

Author 1:

Dr Sarah Prestridge
School of Education and Professional Studies
Griffith University
Nathan Q 4111
s.prestridge@griffith.edu.au

Dr Prestridge researches in the nexus between digital pedagogies, teacher beliefs and professional development. In drawing these three areas together, her research has theorised how to change teacher beliefs through triggers in professional inquiry which shift the ways teachers use digital technologies.

Author 2:

Dr Jo Tondeur
Vrije Universiteit Brussel
Interfacultaire lerarenopleiding
Jo.tondeur@vub.ac.be

Dr Tondeur research interests are in the field of instructional design and educational innovation. Most of his work focuses on ICT integration in teaching and learning processes.

Author 3:

Anne T Ottenbreit-Leftwich
Indiana University Bloomington
aleftwic@indiana.edu

Dr. Leftwich's expertise lies in the areas of the design of curriculum resources, the use of technology to support pre-service teacher training, and development/implementation of professional development for teachers and teacher educators.

Abstract

With the permeation of the Internet in teacher's personal and professional life, teachers are going online to connect, share ideas and expand their learning opportunities. This qualitative study focuses on the use of digital applications that leverage opportunities for teachers in the design phase, that is, at the time they are developing and curating curriculum materials and designing learning sequences within their discipline areas before implementation in the classroom. Data drawn for this paper is part of a research project examining expert ICT teacher's approaches to their ongoing online professional learning. Semi-structured interviews of internationally recognized ICT-expert, specifically from Australia, Europe and United States of America are the main data source. The findings suggest that each teacher leveraged their online social media as their first approach or starting point within their design activities, with a curiosity to investigate the pedagogical application of a 'new' tool. These teachers looked first to the expertise of the colleague for their recommendation of the tool, engaging in little pedagogical reasoning before implementation. Additionally, elaboration of the term sharing is provided for deeper understandings of the ways teachers engage in their professional learning networks.

1. Introduction

Many teachers are creating and participating in expansive social networks called personal learning networks (PLN). Trust (2012) described PLNs as a "system of interpersonal connections and resources" that can be used for informal learning, collaboration, and exchanging knowledge and ideas (p. 133). Online, PLNs are created predominantly through education-focused blogs, wikis, and podcasts, as well as through social media sites like Edmodo, Facebook, and Twitter. Teachers can choose to join a defined online group or community focused on their professional interests, needs or subject domain. These online communities can be open or closed, requiring acceptance into the private space, such as a Facebook group of a Professional Organisation. More flexible online communities also exist through hashtags in Twitter, where tweets can occur at anytime or more streamed chats can occur at a given time (such as #edtech). PLNs can include connections to repositories of resources such as on Pinterest or TeacherPayTeachers site and or educator's blog websites. A PLN therefore is derived from an individual's needs and interests and is represented in the connections they have to people and resources within communities and or independent sites. As such, every PLN is unique and has been defined as 'network individualism' (Castell, 2005). A teacher's PLN can offer places for online collaboration around what they and their colleagues contribute as ideas and resources.

While a number of researchers have explored teacher participation and learning in online spaces (e.g., Trust et al., 2016), Macià and García (2016) suggested that this field of teacher professional learning and engagement in online networks is at a relatively early stage of development. With regard to the use of social media in education, there has been more studies that have investigated the single use of a social media application for educational advancement, such as, Facebook and the Final Practicum (Paris, Boston, & Morris, 2015). Studies like these have investigated the use of social media within a course structure or a

contained professional development program. There is currently less known about the free flowing, organic use of social media that derives from individual teachers' engagement pathways. What has been found within this context, is that teachers are going online to collaborate on certain topics of interest (Jenkins, Clinton, Purushotma, Robinson, & Weigel, 2009; Lu 2011), to escape the philosophical or methodological isolation within their schools (Carpenter & Krutka, 2014) and to gather new ideas and resources (Trust, 2017). This is supported by the finding that teachers' engagement online is underpinned by their short-term immediate needs (Hood, 2017) rather than long-term professional goals. Consequently, we know that teachers use social media to connect with like-minded colleagues and obtain new ideas and resources for point in time needs.

In this free flowing organic modality, the question remains, at what point in time during their core work as a teacher, how and why they particularly turn to social media and their professional learning networks. Additionally, our current understanding of organic engagement in PLNs is predominantly based on quantitative measures (see Trust, Krutka, & Carpenter 2016; Visser, Evering & Barrett, 2014). If we are to understand the complex nature of teacher professional actions within a knowledge system then we must move to teachers' personal experiences about how they conceptualise and reason in these socially mediated spaces (Wenger, McDermott & Snyder, 2002). Teaching requires multi-faceted actions in regard to the typical sequence of planning, implementing and evaluating. Rather than investigate each of these phases, the planning or design phase of teacher's core work was chosen for this study as it is considered the space where new ideas and resources are more likely to be sought by teachers. Therefore, in the current study, we are asking a very pointed question by drawing on qualitative processes: *How do teachers use social media in the curriculum design phase?*

Before presenting the study design, the findings, and resulting implications for educational stakeholders, we first present the theoretical background about 1) the relationship between curriculum design and technology, and 2) the impact of social media on professional learning, as both elements have become closely intertwined in the findings of the current study.

2. Background

2.1 Curriculum Design and technology

Although there are many instances where teachers develop curriculum collaboratively, Kali, McKenney, and Sagy (2015) found that teachers often design curriculum in small segments that aligns with their current practices. The design process is multifaceted and can involve learning, problem-solving, and creating solutions for the problem (Lawson & Dorst, 2009). According to Kirschner (2015), teachers are designers of curriculum and proceed through a process to develop curriculum: "gathering information about the learners, diagnosing/determining what is best for the learners, determining an effective and/or efficient course of instruction, teaching/carrying out the instruction; [and] evaluating whether that which was intended was actually achieved" (p. 311). Kirschner (2015) and others (Ertmer & Ottenbreit-Leftwich, 2013; Sang, Valcke, van Braak, Zhu & Tondeur, 2012) have argued that technology should not be considered a completely novel approach, but just another tool. When teachers design educational technology tools, they tend to consider those practices,

and select resources (or design resources) that align with their current pedagogical approaches (Prestridge, 2017). For example, in a study of eight exemplary technology-using teachers, Ottenbreit-Leftwich, Glazewski, Newby, and Ertmer (2010) found that all respondents used technology to customize materials for their classrooms, ranging from websites to rubrics to quizzes.

Tools that support design could, for example, guide the processes of creating new activities or resources, or help teachers assemble and curate existing resources in ways that foster alignment between aims, learning activities and assessment (McKenney & Mor, 2015). Boschman, McKenney, and Voogt (2014) examined how three teams of kindergarten teachers designed technology-enhanced early literacy projects. They found that teachers' beliefs heavily influenced how teachers designed and implemented technology-enhanced projects in their classrooms. Boschman and colleagues (2014) found that "when teachers use, adapt, or (re)design curriculum material to fit their practice they make decisions based on (a) their practical knowledge—the personal knowledge base accumulated through experience in teaching and (b) their knowledge and beliefs related to how curriculum material is designed, adapted or used" (p. 395). This could lead to a re-conceptualization of the way professional development is set up for curriculum design; one that is informed by a practice-orientated teacher education model (Lim, Tondur, Nastiti, & Pagram, 2014). In such a model, teachers' existing curriculum materials is the starting point for their professional learning activities; teachers are provided with opportunities and (online) scaffolding to reflect upon curriculum design and identify areas for improvement or change. This is commonly considered in formal professional development model approaches where outside experts scaffold teacher progress. Whereas in professional learning activities that are self-generating through a teacher's informal online PLN, such curriculum thought work can also be scaffolded within online communities. It is in these spaces where we examine the process of curriculum design activities. This brings us to the next section.

2.2 Professional learning activities through social media

Literature has suggested that online PLNs can increase a teachers' professionalism, augment their experiences, and update their subject knowledge (Tondeur, Forkosh-Baruch, Prestridge, Albion, & Edirisinghe, 2016). This is possible through (1) solicitation – request for help or ideas, (2) clarification – giving more pertinent details about a topic, (3) discussions on lessons and students work and (4) affiliations in online communities of practice (Veletsianos, 2011). To illustrate this point, Trust, Krutka, and Carpenter (2016) surveyed 732 Preparatory to grade 12 teachers on their participation in online professional networks. The teachers reported that their participation in online professional networks helped them become more confident teachers who were willing to take risks, make mistakes, and learn from failures and become risk taker which allowed their students more unique learning opportunities. They used the gained knowledge to enhance or supplement their lessons. These teachers adapted the knowledge based on their students' needs, interests and skills, and implemented it into their classroom contexts. In many ways, the changes teachers reported in their teaching practices and consequent student learning mirrored the affective, social, and cognitive aspects of growth that teachers reported through their PLNs. Teachers use Twitter chats to be connected and share and receive ideas and also noted a shift in mindset

from passively awaiting training towards active ownership of their professional growth. Most of the respondents reported that learning with people in their PLNs resulted in significant changes in the ways they reflected on and thought about teaching.

Macià and García (2016) examined 23 studies focused on self-organized teacher online communities or networks for professional development. In similar findings to Trust, Krutka and Carpenter (2016), they found that teachers used these communities “to share experiences, knowledge and materials, as well as provide emotional support, develop collective projects and offer skills training” (p. 298). Consequently, support for emotional, social and cognitive growth have been reported as professional learning outcomes from engagement in professional networks. These professional learning processes will be explored more explicitly to gain a sense of what is currently known in this field.

Seeking assistance

Teachers described how they used tools as blogs, Wiki, Facebook, participating in Twitter chats, using virtual conferencing tools to talk in real time, and using social bookmarking tools to collect resources (Carpenter & Krutka, 2016; Hutchison & Colwell, 2012; Kelly & Antonio, 2016; Ranieri, Manca & Fini, 2012; Visser, Evering & Barrett, 2014; Zhang, Liu, Chen, Wang, & Huang, 2017). Teachers also utilized their Twitter network to intentionally enhance their own knowledge and practice. They also often posted their questions online to get help and attended webinars to learn something new from their networks (Tour, 2017). For instance, teachers requested examples and resources that they could use in their teaching; recommendations and assistance on skill development; and information about specific topics. While these inquiries can be described as requests for assistance, they also demonstrate a ‘consumerist culture’ (Prestridge, 2018) that highlights the collecting of resources rather than the more learner centric activities of co-constructing curriculum materials. Providing assistance, feedback, and input to others is another characteristic of scholars’ participation on Twitter (Baran & Cagiltay, 2010; Tour, 2017).

Clarification

In Khan’s (2014) study, teachers in a closed social network- English Subject Ning, were observed asking and answering questions to clarify disagreement, such as, identifying and stating areas of advice and encouragement about curriculum content and debate around curriculum development. From different discussions, it was revealed that knowledge was passed from expert teachers to the more recent attendees by asking and answering questions to clarify the source and extent of disagreement, or restating the participants’ position, and possibly advancing arguments or considerations in its support by references to the participants’ experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view. These include sharing new knowledge and creations in a collaborative environment, staying connected with other members, gaining professional recognition, seeking advices and suggestions from experienced teachers, and above, all getting innovative and real-life tips and strategies for improving pedagogical practices.

Sharing with and about student’s work

Teachers network in order to enhance their teaching by seeking input, sharing their work, engaging in conversation with others, and sharing student work (Forte, Humphreys, & Park, 2012; Niesz, 2010; Wesley 2013; Zhang, Liu, & Wang, 2017). Through these actions teachers seek enhanced learning opportunities for their students, and are willing to share teaching practices and artefacts outside of the classroom presumably because there are benefits that may be derived from their students having an expanded audience. These actions also indicate that participants capitalize on the affordances of the technology to bring together distributed expertise and introduce learners to individuals who are knowledgeable about a topic of study. The teachers who were part of this study used the Twitter network as a way to make classroom activities/ information available to others and to provide opportunities for students to interact with individuals outside of the classroom. For instance, participants asked others to help their students with questions they had.

Reciprocal practices

Teachers believe that when they actively participate in sharing as well as discussing their own resources, distributed learning occurs online (Trust, 2016). This suggests that shift in learning is more likely to happen when networking practices are collaborative, exploratory and pro-active. For some teachers, distributed learning did not occur as they chose to take the form of active observers or lurkers which often positioned them as passive recipients of knowledge. Results from Hew and Hara's (2007) and then again ten years later by Zhang, Liu and Wang (2017) suggests that teachers with a larger number of years of work experience were more likely to share knowledge more frequently than teachers with lesser years. Hou, Chang and Sung (2009) reported on the basis of the discovered behavioural patterns in their study, that although blogs can serve as a channel for teachers to share teaching information, the aspect of knowledge construction is limited in absence of participation. They found that a large number of teachers prefer a passive role, taking benefit from the conversations held by others and their shared materials but rarely expressing their own opinion.

Teachers are seeking assistance, asking questions to clarify ideas, contributing and taking resources, discussing curriculum materials and sharing student work within bounded online communities and through open personal networks. Collaboration, participation, sharing (all action verbs) and even lurking are foregrounding professional learning actions in these online spaces. These professional learning actions are considered effective in supporting teacher knowledge construction and professional growth in programs in any place or space, at school or online, where the teacher is the driver and active participant in their learning (Prestridge & Main, 2018; Raphael, Vasquez, Fortune, Gavelek, & Au, 2014). Additionally, the current literature indicates that more experienced teachers are more likely to be active contributors and support the more recent or less experienced teachers in a community, with most teachers being passive participants online. Drawing on these theoretical understandings, a hypothesis can be suggested that teachers, who have been teaching longer, or who are considered 'experienced', use their professional learning networks through social media to connect with colleagues to collaborate with (seek assistance/discuss ideas-planning) and take resources when in the curriculum design phase. In order to extrapolate this to understand more specifically the professional learning actions of *teachers' social media use in the curriculum design phase* the study will now be discussed.

Research method

This qualitative study, with semi-structured interviews as the data collection tool, involved fifteen ICT-expert teachers from three different regions: Queensland-Australia, Flemish-Belgium and Indiana-United States of America. The diversity and culture can lead to broader perspectives on teachers learning online and their approaches to space/place flexibility with colleagues from around the world.

This qualitative study, with semi-structured interviews as the data collection tool, involved fifteen ICT-expert teachers from three different regions: Queensland-Australia, Flemish-Belgium and Indiana-United States of America. The diversity of locality and culture were chosen to mirror the notion of working online, the space/place flexibility where colleagues around the world collaborate. Expert ICT teachers were considered more experienced with the complexities of teaching with technologies. The teachers were targeted as participants (Intensity Sampling- Teddlie and Yu 2007). Each researcher selected five participants based on the criteria that they were (1) perceived by their local educational communities as an 'ICT-expert'; (2) that they provided professional development to their colleagues at school, district or state level; and/or (3) they had won an award for their ICT-expertise. Table 1 provides a list of the teachers (pseudonyms) with their relative expertise.

[Table 1 near here]

The interviews included eight semi-structured questions that focused on the development of background (to identify expertise and build rapport); understandings of professional development and learning generally as well as specifically associated with social media and networking with questions such as: *What is the most effective form of professional development for you as an ICT leader? How much time do you invest in your own professional learning? Why do you use social media? What is the purpose of learning in this way?*; issues around limitations associated with cultural and political context with questions such as: *Are there policies or cultural elements that limit your PD or PL?*; followed by a behavioural event sequence that guided each teacher in explicating their learning online to application in the classroom. This behavioural event sequence required each teacher to create a detailed narrative organizing their ideas into headlines, summaries, and key events. For example, a headline could have been *'Well who wants to Mystery Skype?'* followed by the teacher detailing their professional learning event/s, their thinking, feeling and actions to apply such learning to classroom practice. The researcher teased out the teachers' accounts by prompting, clarifying and guiding the behavioural event sequence. The full interview took on average approximately one hour.

The three researchers from different locations were unable to co-interview. Therefore, there was a standardisation of questioning and a schedule co-developed prior to the interviews with the acknowledgment that context and ebb and flow may alter phasing and sequencing of the questions. This ensured some flexibility associated with context to ensure that personalised views of networked online learning could be captured. Oppenheim (1992) and Patton (1980) both supported this approach to interviewing as the purpose was to enable the participant to talk candidly, with emotion (and passion) and honesty, especially in the context of experiences that do not comply with policies, culture, and standardised professional development

activities. Interviews were held during the academic year between June 2016 - June 2017. Each teacher received the interview schedules prior to the interview to familiarise themselves. All interviews were transcribed and adhered to ethical requirements (GU Ref No: 2016/656).

Interview data was analysed through an inductive thematic process of examining, comparing, conceptualising and categorising the data (Strauss & Cobin, 1990). Inductive codes were assigned to initial larger segments of data that described a new theme. Two coders individually coded one interview from the same respondent. Subsequently, the coded units were compared in order to discuss disagreements, refine categories and develop a shared coding scheme. During the data analysis of the other respondents, the coding was discussed among the researchers to safeguard the quality of the interpretative data. All disagreements and interpretations were resolved through discussion. Finally, patterns and differences across the respondents were identified through constant comparisons. Themes that are familiar with 'what' teachers' are doing through social media/networking were evidenced such as 'Finding New Tool/Apps' or 'Resource sharing' while other themes were more eclectic such as 'Crowd sourcing' and 'Collaborative mindshifts'. During the analytical process, broad 'what' themes (Finding New Tool/Apps' or 'Resource sharing') were examined along two dimensions: 'how' these teachers are engaging in professional actions- sharing, collaborating, connecting etc- through social media and 'why,' their pedagogical reasoning in the curriculum design phase. As a result, examination of the data revealed professional actions underpinned by pedagogical reasoning. It was considered more authentic to combine these dimensions to develop a picture of activity online in each theme. The two themes will be explored in the next section.

This research sought to understand how teachers use social media in the curriculum design phase. Due to this narrowing of the research focus, a further representation of data was deemed relevant. To truly represent how teachers mediate between their online professional learning, their curriculum planning and pedagogical reasoning three short vignettes are presented. Three defining processes that ICT expert teachers mediate their use of social media have been chosen as illustrations of varying practice. These three teachers, out of the 15 ICT expert teachers, were chosen based on Asmussen and Creswell's (1995) sampling strategy to select unusual cases with maximum variation within representative clusters. The vignettes have been formulated from the behavioural event sequence of the interview (McClelland, 1978). The behavioural event sequence involved an iterative process that asked the ICT expert teachers to explicate each step of an experience, this being, professional action/s through social media that related to the design of curricula. The vignettes draw heavily on interview excerpts blended with descriptive pose to provide the opportunity to illustrate, from the teacher's perspective, how they were responding to the contextual (social media) conditions (Yin, 2014). A narrowing and deep interview segment is well recognized as an approach to support the investigation of particular phenomenon (such as professional learning) within a real-life context. The following section will present the themes that emerged from the interviews followed by short cases as illustrations of practice.

Results

We sought to investigate *How do teachers use social media in their curriculum design?* All fifteen teachers stated that they used social media as their primary form of professional learning. Although Twitter was the most commonly mentioned online tool, they also turned

to Facebook often as well. Twitter seemed to be their 'go to' medium with responses such as *"My Twitter is my personal learning network"*; *"Twitter is probably my biggest area of professional learning"*; and *"Twitter's definitely my biggest influence."* They also described examining YouTube clips, Pinterest, reading blogs and articles/readings, as well as subscribing to new feeds. Accessibility was a notable affordance associated with physicality as well as the time and place flexibilities summed up in this statement: *"They're all over the world, and they're right in my pocket, and I can take it out whenever I get five minutes, instead of having anything formal."* From this statement and replicated by all teachers was the purpose of using Twitter, that being the *"broaden my social network"*, reasoning that it easily allows these teachers to connect with educators who are like minded. These reasonings are strongly evidenced in the literature through notions of professional actions of sharing, collaborating and connecting. However, in the results presented below we go one step deeper, to look at how and why these teachers are sharing, collaborating and connecting to 'broaden their social networks'. The following themes draw from the analysis intend to give us a representation of ICT expert teachers use social media.

Theme 1: Parameters associated with finding new ICT tools- a Technological social-pedagogical dichotomy

All of the ICT expert teachers used social media in their curriculum design to stay up-to-date on new innovations in technology. They described relying heavily on their PLNs and YouTube for new ICT tools and how these worked, usually trying them out first in their own classroom/school context before sharing them with their school colleagues. ICT expert teachers described that one of the main reasons they reviewed Twitter feeds, participated in Twitter chats and/or searched social media was to stay current on new ICT innovations. These teachers all considered themselves knowledgeable in a range of software and applications but still felt that they needed to keep abreast of new developments in the field. These excerpts indicate this technological reasoning:

Shaun: I'm on Twitter a decent amount. Things pop up a lot, and I'll investigate. If I see things popping up a lot and I don't know what it is, I'll investigate. In the beginning when I was just so hungry to learn, I would type in #edtech or things like that. And I would look under the top 100 apps in the classroom, and I would look and read through the apps and click on all of them and download them and try them. Now it's not so much that, because I feel like I know a lot and I don't need to necessarily find the next app.

Pia: We have so much information on the internet which is very valuable, and which allows me to get along with things, just the things that I need. That's very interesting for me. It allows me to focus on, really, what I want to learn.

Every ICT expert teacher wanted to maintain their finger on the pulse of new ICT innovations. However, they also indicated that, due to their extensive experiences and knowledge in this field, that initial urgency to find out more about the ICT tool was not as important, so their 'waiting lists' to explore at a later date were extending. These experts understood the power of their social media in regard to finding new innovations but they also understood, more importantly, that this was valuable only when the new innovation related to their pedagogical

and or student learning needs. Additionally, for a new innovation to move from a waiting list or be considered for further investigation, it needed to be recommended by an esteemed colleague. 'My social network' or 'my personal learning network' defined parameters for ICT tool innovations. The following experts explain their reasoning

Tasha: I learned everything about Google Classroom through Twitter. There's a woman in the United States. She's a bit like the goddess of Google Classroom, and that's how I keep up. I follow her on Twitter. I read her things. I watch her videos. I test them out in my classrooms, and then I share them with other teachers, on Facebook, on Twitter.

Carol: I follow Richard Byrne's Free Technology for Teachers on Facebook, and I have his blog on my weekly feed. Just kind of redundant. He posts so much stuff all the time, and so usually I open up that tab, even if I can't read it. And so then later in the day, I'll try to come back and see what it is, and see if it's something that I think might be useful.

Who makes the recommendation, their level of respectability in the field to the given ICT expert, is an important variable in the speed of the uptake of the ICT tool. There is evidence of a concomitant relationship between social and technological reasoning in these expert ICT teachers' use of social media and networks. However, in these bursts of exploration, there was some evidence of technological reasoning overriding pedagogical reasoning. The idea of a new innovation foregrounding its pedagogical appropriateness was evident when ICT experts implemented the new ICT tool they had found through their social networks with minimal consideration for its educational value. The recommendation given online by the notable colleague was all that was required for experimentation and appropriation in classrooms. This may be due to the pedagogical notability of the online colleague, however, there was little mention of a thorough pedagogical examination prior to trialling in classrooms. The following experts evidence this mode of appropriation:

Brad: I remember very clearly through following Shaun Wheeler on Twitter which is a professor in University of Brighton. Twitter suggests a number of other accounts based on your interests and based on your profile, so through his profile I suddenly saw Educaplay which is an online platform for creating exercises, a kind of 'hot potato' but in the cloud. And I said, 'oh wow that's interesting.' So I stopped, I remember very vividly that at that point I was working on a kind of report for some of my students in the teacher training programme. I stopped and then I had the curiosity of simply doing and exploring that tool. I made an account. I said, 'okay these are interesting tools, these are interesting exercises, we can do something with it in the teachers training programme' and we did at that time.

This technological-social-pedagogical dichotomy as a social media contextualised ICT tool adoption process is understandable in the context of expert teachers networking with like-minded expert teachers. These expert ICT teachers who have extensive pedagogical experience and knowledge would be likely to make informed decisions based on small amounts of socially represented information. These ICT expert teachers are evaluating ICT tools as well as social representations against their own pedagogical framework to adapt and appropriate the tool into their classroom and or professional development/training context.

This initial evaluation process in social media spaces either leaves the ICT tool on the *list* or it stimulates the transformation of the knowledge of the tool to teachable representation in their educational context. Greater representation of the process will be evidenced in the vignettes.

Theme 2: The purpose of the engagers or engagement directs the choice of social media

All the ICT experts were selective of which social media tool they use depending on their purpose for their professional learning needs. These ICT experts would be considered authorities on social media as they spend anywhere from four hours to twenty hours a week in these online environments. Due to their experience and high level of use, they suggest particular tools for the more inexperienced teachers,

Brad: More on Facebook I think, it's kind of the fluid nature and the rapid nature of Twitter kind of holds back people. I think teachers are more acquainted personally with the use of Facebook because of course they're sharing a lot on their holidays and so on, and I think they are more able to work with the technology of Facebook than with Twitter. Sometimes teachers still say, 'okay what's that Twitter? All those tweets and it's so fast, so volatile.' It's fluid. But then again on Twitter, and that's why I call it professional strategy which really can make a difference, you need to be able to find to expand your network and finding the right people can be more effective and quickly on Twitter. Because on Facebook you're always rely on the friend request and the acceptance of the friend request...the open and very volatile nature of Twitter; and Facebook these are closed groups, perhaps that makes it easier for people to start sharing a problem.

The Facebook or Twitter choice is interesting. All but one ICT expert teachers used Twitter as their first port of call for their professional learning. Pia was the only expert who stated that she didn't use Twitter but instead connects with her existing school based colleagues (past and present school) over the phone. Twitter is advocated for its ability to network with colleagues beyond their existing professional realm. However, Twitter seems to be considered a more advanced, more unfamiliar networking tool that can be chaotic and therefore difficult to use for the less experienced user. Facebook, based on its more general social applications offers a more familiar environment with closed groups for sharing of resources: *'There are Facebook groups for lesson plans and lesson ideas on teaching secondary education, for starting teachers, subject ones...'*. Brad acknowledged that closed groups on Facebook help teachers as it *'makes it easier for people to start sharing a problem'* because it is private. The volatile and public nature of Twitter (with no friend request) offers limitless opportunity for the ICT expert but a complex chaotic, threatening space for non-familiar user not as versed with social networking and or ICT expertise. However, these more complex characteristics of Twitter can be beneficial for the more inexperienced teacher as identified by James who advocates for project based learning with his teachers at this school:

James: This year, we were project-based and the kids were showing what they've learned. They (teachers) can see in the curriculum that the kids have to know how to build websites, and so I can show them how to build a website, but it's a lot more than just learning how to build a website. It's how can I represent this knowledge in a way that I can share it with people. That change of mindset is the biggest part, and the most difficult part, I guess, to convey to the teachers. Twitters is a huge help, and seeing that it's not just me that's doing this and it's not just a crazy idea that I've had. That there's actually thousands of teachers from around the world who are working like this so it's great to have the support of other people showing how it's working for them. I try and feed little bits of information slowly so that it's not over whelming, and now quite a lot of them are on Twitter and they're active in Twitter chats. There is quite a lot of slow tedious teaching them how to do things, or learning how to use new software, but we're getting there.

James advocates the use of Twitter with his colleagues to help them change their mindsets about project based learning, as it is more likely that these teachers will have greater opportunities to explore and see different mindsets about teaching and learning on Twitter than Facebook. With the uptake increasing at his school, he still admits that out of a large teaching staff (approx. 160 teachers) ‘probably three classes who are doing it properly’. Twitter, though offers the opportunity to expand ideas and validate effective practice with ICT, it is used to stimulate professional conversations at the school level:

James: I try and feed little bits of information slowly so that it's not over whelming, and now quite a lot of them (teachers) are on Twitter and they're active in Twitter chats. They're coming up with things that I'm not showing them that they're doing on their own, and trying to develop their class on their own. There is quite a lot of slow tedious teaching them how to do things, or learning how to use new software, but we're getting there.

As indicated in this excerpt, James uses Twitter as a professional development tool to support a growth mindset in the use of ICT with his colleagues at his school. In more general terms, other ICT experts stated that they used particular social media for specific reasons, for example: for generally educational perspectives on teaching approaches (e.g., video in the classroom) Brian uses TED Talks; for practical classroom resources (maths tasks) Barbara uses Pinterest; for keeping in-contact with key people who've got their finger on the pulse Kate uses blogs; to store hyperlinks and interesting articles, Brad uses Diigo; to share resources and connect with teachers worldwide June joins MOOCS which often have discussion forums and tasks that involve posting ideas and resources; to join the conversation at a conference Donna is attending, she will use Twitter intensely but not at other times; to watch the conversation at a conference or event that Kristy cannot attend she will watches the Twitter feed and finally Kate states that ‘My social life will be on Facebook and my professional life is in Twitter. I draw that line.’ These ICT experts are making purposeful choices on the social media tools they are using for themselves, personally and professionally, for curriculum needs and professional needs and making choices on social media for supporting the professional learning needs of their colleagues’. These choices are made with regard to the functionality of the social media tool.

Vignettes: illustrations of social mediated practice

In responding further to the question for this study: *How do teachers use social media in their curriculum design?* the following vignettes represent a collective descriptive recount of three ICT expert teachers' experiences with social media as they were designing curriculum for implementation in their classroom as part of the behavioural event sequence in the interview. In keeping with the behavioural event approach the teachers' headliners are used. The vignettes highlight three different professional actions and reasoning. Vignette 1 identifies that as a first point of call this teacher turned to social media for inspiration to help her students learn the alphabet. In Vignette 2 a form of collective sharing is described as this teacher crowd sourced ideas for good mobile Apps through Twitter. While in Vignette 3 getting specific feedback and validation of curriculum design ideas was the reason for engagement on social media. These reasonings and actions broaden the current literature and will be presented respectively as variant representations of the 15 ICT expert teachers' use of social media in the curriculum design phase.

Vignette 1: 'Diving into Interactive Notebooks with Kindergartners'

Barbara has been a kindergarten teacher for 11 years. She has always had technology in her classroom with iPads 1:1 for the last five years. She is an ambassador for Technology companies and supports her colleagues to integrate technologies. Learning the alphabet was a boring process and she was becoming frustrated with what she had done in the past. She stated that *'I haven't had what I feel is great engaging success in kids not just learning their alphabet, but retaining their alphabet and letter sounds. So I searched Pinterest, I searched education blogs, I reached out on Twitter to companies and stuff, and I discovered digital interactive notebooks with Book Creator, and in this process, I believe I found Book Creator on Twitter.* Barbara downloaded the lite version and found it so simple with blank pages and features to import images etc. She acknowledged that it was content-free, easy to use and *'whatever the kids wanted to make of it really'*. At this point she was assessing its pedagogical adaptability. She tried it out in the classroom at the beginning of the year. She showed the children the Book Creator app, modelling how to use it and *"there were tons of questions"*. The second time she used it, the children were doing it on their own and *"I just remember feeling like a huge success, because not only did they complete their alphabet notebooks, but they also completed a digital book"*. By Christmas the children knew their letters and sound and had made their own digital books. Barbara acknowledged that they were retaining the information and they were learning to use these tools as proficiently as possible.

Vignette 2: 'Brand Creatively Connects the apps'

Having been a high school teacher who taught professional self-understanding for 12 years, completing research in ICT innovation at University then moving onto teacher training as a professional development provider, Brad has extensive experience in using ICT in classrooms. He insists that sharing and networking with colleagues is the basis of professional learning. *'I share almost everything. And I also take initiative to gather ideas of other people in my network'*. For example, Brad launched a Google Doc on Twitter for everybody in the world, asking for good mobile apps, with details such as cost, subject applicability'. He often retweeted it for growth and currency. On the list was the Socrative app. A colleague Alda, saw

the app and had also seen it at a schooling event or conference and asked Brad to help her 'do something with it'. Brad and Alda explored the app together and planned some ideas. Brad asked her to relate it to what she was currently doing in the classroom. Within the week Alda had tried it out in her classroom. Another teacher, a maths teacher, who was part of Brad's professional development course, was also interested in the Socrative app. He also tried it out in his classroom. Brad called this a '*creative interchange that can really go fast, but it also has to do with feelings, I think*'. It is what he calls creative group development plans. He believes that teaching is still a very individual profession but we need to come together informally and share things more.

Vignette 3: 'Connect with your professional learning network'

'My main responsibility is Leader of E-learning and Library Services'. Donna has been teaching computer studies in high school for over 20 years. She has just completed a PhD. She joins in on Twitter chats every couple of weeks around computing studies. There's one on Sunday nights, she sometimes gets motivated to just lurk in as it's a good way to connect with people that are actually doing the same subjects. She uses HootSuite as she can see a couple of things going on at once. *"I wouldn't say that I sit down and talk or tweet every day. I tweet more at conference"*. When she has spare time like when waiting for a train, she sees what other people in her network are doing, talking about, or tweeting about, then she'll have a look at what's been tweeted in the last hour or day or whatever. Donna does this because those people often have either good resource to share or they're quite informed. For her it's a way to swap resources. For example, one of her colleagues in a Multimedia group put a tweet out to share exam papers. *"It's just really cool to see what other people are doing. In most cases people are mostly, they want to share themselves"*. Donna explains that lots of units of work are shared, tweeted out. Because it is your *subject* and your *colleagues* she says that you can ask really specific things in those kinds of spaces. She says that she can tweet, *"This is what I'm doing. Am I on the right track?"* Donna can get specific responses to her unit planning or ideas so for her it is a good source of professional validation and feedback in the design phase.

Discussion with conclusions

In responding to the question, *How do teachers use social media in the curriculum design phase?* we found that ICT expert teachers turn first to social media to find new ICT tools as a response to a curriculum need and or to maintain technological currency. Since the majority of these expert teachers are 'living' online, mainly in Twitter, they are actively seeking new ICT tools constantly. It has become part of their professionalism where immediate adoption is actioned rather than compartmentalised into a phase. The curation of resources through social media and networks has been identified as a significant purpose for engagement in these environments (Trust, Carpenter, & Krupta, 2016). However, the curation process and the appropriation of these resources has not yet been explicated.

This study has identified that the social network, of chosen esteemed colleagues, plays a significant role in the pedagogical affordances of the new tool. In the majority, these teachers linked the expert to the tool, in some cases, actively targeted certain people online to learn about their adoption process of a tool, and or used an ICT tool based on its connection to an expert. These connections to people meant that, firstly, these teachers engage in minimal pedagogical reasoning before they appropriated the innovation in their classrooms. Secondly,

the people or the experts in a social network are highly valued and are foregrounded before the ICT tool. This conflicts with the findings of Hood (2017) who found teachers, in her study, tend to engage directly to the knowledge artefact and by-pass the need to have interaction with the knowledge creator. Her study was contained to two closed online organisation-based communities and extrapolated the concept of networked individualism. In this instance, where professional actions were examined within a closed community, the teachers engaged independently to collaboratively obtain information and a sense of belonging. In contrast, in the current study, teachers were operating within an organic, open, self-directed network of people and resources, and their esteemed colleague's social capital mattered in regard to the likelihood of ensuing professional actions and appropriation of the idea/tool.

A second finding contributes to the notion of effective professional learning within social media, with regard to the action of distributed contribution to the development of shared knowledge creation. To maintain membership within a knowledge creating community, teachers need to collaborate by actively elaborating on their ideas and experiences and actively interacting with others' ideas and experiences (Garber, 2004). In an online community, this occurs through teacher's active interactions and contributions rather than when teachers are lurkers, consuming other's ideas/resources (Brantzaeg & Heim, 2011; Wenger, McDermott, & Snyder, 2002). Hou (2015) defines beneficial online professional actions as interaction that are multiple, reciprocal and iterative, where each interaction receives input from, and provides output to, another interaction.

In this study, the findings illustrate that there was variance in the ways ICT expert teachers interacted online. In the first theme that was representative of all ICT expert teachers, there was a focus on consuming knowledge by seeking new ideas (latest ICT tools) and curating resources. These findings are in line with others studies which indicate the majority of teachers demonstrated a consuming culture online (Prestridge, 2016; Hou, et. Al., 2009; Zhang, et al. 2017). However, there was also evidence of unique ways that these ICT expert teachers contributed to the co-creation of knowledge, which aligned to the designing of curriculum materials and to their role as leaders in their PLNs at school and online. Out of the 15 ICT experts, three teachers described only consuming behaviours. The majority of teachers, 12, indicated that they retweeted 'good' ideas, shared their own curriculum materials, and posted comments in blogs and online groups. To illustrate this finding in more depth, that is, to elaborate on 'sharing', which was one of the purposes of this research, the vignettes provide further evidence.

The vignettes represent three varied approaches to professional learning online. Barbara used social media to find an app to better support her students' learning the alphabet. This resource seeking behaviour was typical of consumerist behaviour. Brad, on the other hand was focused on sharing. He emphasized the importance of using his PLN to network as opposed to finding the best app. He positioned collaboration as pivotal in disseminating information and planning curriculum. He was proactive in sharing by crowd sourcing community ideas and then disseminating these online and with work place colleagues. Sharing meant generating collective ideas. Additionally, Donna described being more active when she was engaging with her subject colleagues online, specifically sharing curriculum materials such as unit plans and exams but more importantly, sharing her own work for peer validation. She posted her planning for her online colleague's feedback and direction. Sharing meant collaborative

corroboration. These vignettes identify ICT expert teachers' use of social media as grounded in curriculum design, with the possibility of greater in-situ or in-progress curriculum re-design, targeted support and on-going collaboration. The idea that team-planning or Twitter-planning or what Brad called '*creative group development plans*' is possible and probable. Others have discussed the importance of team planning. In fact, in most successful teacher communities of practice, the most important aspect is being able to collaborate together (Voogt, Pieters, & Handelzalts, 2016).

The themes found in this study, uncover critical understandings on the professional learning actions that occur through social media in the curriculum design phase. There is a blending of technological-social-pedagogical reasoning that identifies a premise for ICT tool adoption leveraged through social media. Evidenced in theme 1 as well as the vignettes is a process of ICT innovation based on socially founded pedagogical recommendations followed by an experimentation period in the classroom. This adoption process, does not always include in-depth or some level of pedagogical investigation online prior to experimentation, it relies heavily on peer validation and positions pedagogical framing in-situ in social media and pedagogical transformation in the phase of implementation. What is opportunistic within online social media environments is the accessibility of peer review and socially based professional support which has been emphasised as an enriching and necessary element of curriculum study as part of professional development. Currently, research has identified that the feedback cycle can occur as part of more formal online professional development programs (see Goodyear, Casey, & Kirk, 2014; McGowan et al, 2012) where participants are facilitated to make contributions, for example, in Facebook groups. However, the more organic self-directed independent professional learning adopted by these ICT experts needs further investigation to ascertain to what extent the notion of teacher inquiry exists or can exist in these social media environments.

The purpose for engaging online as well as the functionality of the social media tool directs the ICT experts' choice and use. Twitter was the most commonly used tool for keeping abreast of new tech innovations as well as new educational ideas from like-minded colleagues evidenced in theme 2. The networking aspect of Twitter, that is to maintain and extend professional connections was considered by ICT experts as a necessary function of their professional life but also could be used to extend and open up their colleagues' minds to new educational approaches and perspectives. However, its chaotic and unfamiliar functionality requires technical support and some mentoring if it is to be a beneficial tool for professional development purposes.

In conclusion, as an elaboration of the central hypothesis under test, the findings here suggest that teachers, who are considered 'experienced', use their professional learning networks through social media as their first source for the consumption of ideas/resources, the generating of collective ideas and collaborative corroborations. The findings of this research provide a deeper, more humanistic examination of how teachers are leveraging online tools.

Limitations of the study and directions for future research

Although the current qualitative study has been helpful to explore in-depth the online learning practices of expert teachers from different parts of the world, it also reflects some shortcomings. First, the data source used in this study was limited to self-report data. Future research may integrate observations and field-experiences to examine 1) how expert teachers use digital applications that leverage opportunities in the design of their curriculum materials and 2) how these materials are implemented in their real practice. Additionally, examination of social mediated exchanges such as tweets, posts, chats etc is needed to identify the extent to which teachers are communicating with pedagogically like-minded people and the implications this has for their professional learning. This can lead to a more nuanced and in-depth insight into the impact of social media on the design of curriculum materials. Second, the results of interviews have a limited generalizability. Clearly, the added value of this study lies in the deeper, richer account of online interactions of a selection of ICT expert teachers, such as the choices of specific social media or the more critical understanding of the process of sharing and its elaboration. Furthermore, it is important to explore the use of social media for professional learning and engagement outside the context of Western countries.

Apart from the evaluation of teacher engagement online to support the design of new curriculum materials in other parts of the world, there is also the question of how to select the sample teachers. In future studies, researchers might wish to collect both qualitative and quantitative data to help develop the findings of this study. Specifically, more information is needed about the depth of what is considered professional learning in relation to teacher inquiry/action learning processes as a self-directed activity through social media, the value of such self-directed online networked learning in regard to impact on learning in classrooms, as well as notions of chaotic bursts of learning. Finally, the question remains whether novice teachers can integrate the strategies adopted by the expert teachers. To illustrate, it seems that many novice teachers would be social media users already, so unfamiliarity with for instance Facebook is an unlikely barrier.

Conclusion

Nearly 20 years ago there was a call for a 'heart and minds' approach to teacher professional learning and engagement (Watson, 2001). Teachers self-generating their learning and engagement in online PLNs suggests a shift towards embracing both their heart and mind, as teachers are in charge of driving their unique engagement in pursuit of genuine professional problems with a broader professional community (Prestridge, 2018). As we move into these self-directed approaches to professional learning and engagement there are two directions that need ongoing examination. Firstly, is the need to understand the relationship between informal and formal learning and how these can complement and or even re-shape each other. Secondly, on the level of teacher learning, is the process of pedagogical re-formation and how (and if) free flowing in-determinant engagement can impact or 'trigger' pedagogical change. Additionally, for teachers living and learning in these online modes, do these modes of engagement equate to greater infusion of these opportunities in student learning. This research agrees with Macià and García (2016) that we are at the beginning of a new paradigm of learning for teacher that needs to be explored through both the heart and mind.

References

- Ambler, T. B. (2016). The day-to-day work of primary school teachers: a source of professional learning. *Professional Development in Education*, 42(2), 276-289.
- Asmussen, K. & Creswell, J. (1995) Campus response to a student gunman. *Journal of Higher Education*, 66 (5), 575-591.
- Baran, B., & Cagiltay, K. (2010). The Dynamics of Online Communities in the Activity Theory Framework. *Educational Technology & Society*, 13 (4), 155–166.
- Bielaczyc, K. (2013). Informing design research: Learning from teachers' designs of social infrastructure. *Journal of the Learning Sciences*, 22(2), 258-311.
- Boschman, F., McKenney, S., & Voogt, J. (2014). Understanding decision making in teachers' curriculum design approaches. *Educational technology research and development*, 62(4), 393-416.
- Brandtzaeg, P., & Heim, J. (2011). Typology of social networking sites users. *International Journal of Web Based Communities*, 7(1), 28-51.
- Brown, R., Vissa, J. M., & Mossgrove, J. L. (2012). *The importance of collaboration to new teacher development: Two central features of an induction fellowship*. Yearbook (National Council of Teachers of Mathematics), 74, 103–115.
- Carpenter, J.P. & Krutka, D.G. (2015) Engagement through microblogging: educator professional development via Twitter, *Professional Development in Education*, 41(4), 707-728, DOI: 10.1080/19415257.2014.939294
- Darling-Hammond, L., & McLaughlin, M. W. (1995). *Policies that support professional development in an era of reform*. Phi Delta Kappan, 76(8), 597-604.
- Davenport, T.H. (1993). *Process Innovation. Re-engineering Work through Information Technology*. Boston: Harvard Business School Press.
- Ertmer, P. A., & Ottenbreit-Leftwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education*, 64, 175-182.
- Forte, A., Humphreys, M., and Park, T., (2012). Grassroots professional development: how teachers use Twitter [online]. In: Proceedings of the 6th international AAAI conference on weblogs and social media, 5–7 June, Dublin, Ireland, 106–113. Available from: <http://www.aaai.org/ocs/index.php/ICWSM/ICWSM12/paper/view/4585/4973> [Accessed 15 December, 2017]
- Garber, D. (2004). Growing Virtual Communities. *International Review of Research in Open*

and Distance Learning. 5, (2). Retrieved from: <http://www.irrodl.org/index.php/irrodl/article/view/177/259>

- Goodyear, V. A., Casey, A., & Kirk, D. (2014). Tweet me, message me, like me: Using social media to facilitate pedagogical change within an emerging community of practice. *Sport, Education and Society*, 19(7), 927-943.
- Hanraets, I., Hulsebosch, J., & de Laat, M. (2011). Experiences of pioneers facilitating teacher networks for professional development. *Educational Media International*, 48(2), 85–99.
- Hew, K.F., & Hara, N. (2007). Empirical study of motivators and barriers of teacher online knowledge sharing. *Education Tech Research Development* (2007) 55:573–595 DOI 10.1007/s11423-007-9049-2
- Hood, N. (2017) Conceptualising online knowledge sharing: what teachers' perceptions can tell us, *Technology, Pedagogy and Education*, 26:5, 573-585. DOI: 0.1080/1475939X.2017.1348980
- Hou, H. (2015). What makes an online community of practice work? A situated study of Chinese student teachers' perceptions of online professional learning. *Teaching and Teacher Education*, 46, 6e16.
- Hou, H. T., Chang, K. E., & Sung, Y. T. (2009). Using blogs as a professional development tool for teachers: Analysis of interaction behavioral patterns. *Interactive Learning Environments*, 17(4), 325-340.
- Hutchison, A. & Colwell, J. (2012). Using a wiki to facilitate an online professional learning community for induction and mentoring teachers, *Education, Information Technology*, 17:273–289 DOI 10.1007/s10639-011-9159-7
- Kali, Y., McKenney, S., & Sagy, O. (2015). Teachers as designers of technology enhanced learning. *Instructional Science*, 43(2), 173-179.
- Khan, A. (2014.). Teaching, learning, and professional development in the English companion Ning (Ecn): An online community for English teachers. *International Journal of Arts & Sciences*, 7(3), 347–353
- Khoshhal, Y. (2016). Busy teachers: a case of comparing online teacher-created activities with the ready-made activity resource books. *International Journal of Pedagogies and Learning*, 11(3), 283-300.
- Kirschner, P. A. (2015). Do we need teachers as designers of technology enhanced learning?. *Instructional Science*, 43(2), 309-322.
- Kelly, N. & Antonio, A. (2016). Teacher peer support in social network sites. *Teaching and Teacher Education* 56, 138-149.

- Lawson, B., & Dorst, K. (2009). *Design expertise*. Routledge.
- Lim, C. P., Tondeur, J., Nastiti, H., & Pagram, J. (2014). Educational innovations and pedagogical beliefs: The case of a professional development program for Indonesian teachers. *Journal of Applied Research in Education*, 18, 1-14.
- Little, J. W. (2002). Locating learning in teachers' communities of practice: opening up problems of analysis in records of everyday work. *Teaching and Teacher Education*, 18, 917-946.
- Macia, M., & García, I. (2016). Informal online communities and networks as a source of Teacher professional development: A review. *Teaching and Teacher Education*, 55, 291-307.
- McClelland, D. C. (1978). *Guide to behavioral event interviewing*. Boston: McBer.
- McGowan, B., Wasko, M., Vartabedian, B., Miller, R., Freiherr, D., & Abdolrasulnia, M. (2012). Understanding the factors that influence the adoption and meaningful use of social media by physicians to share medical information. *Journal of Medical Internet Research*, 14(5). doi: 10.2196/jmir.2138.
- McLaughlin, M. W., & Talbert, J. E. (2001). Professional communities and the work of high school teaching. Chicago: University of Chicago Press.
- Niesz, T. (2010) Chasms and bridges: Generativity in the space between educators' communities of practice. *Teaching and Teacher Education*, 26 37–44.
- Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376e407. <http://dx.doi.org/10.3102/0034654311413609>
- Oppenheim, A. (1992) *Questionnaire Design, Interviewing and Attitude Measurement*. London: Pinter.
- Ottenbreit-Leftwich, A. T., Glazewski, K. D., Newby, T. J., & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: Addressing professional and student needs. *Computers & Education*, 55(3), 1321-1335.
- Paris, L., Morris, J., & Boston, J. (2015). Facebook and the Final Practicum: The Impact of Online Peer Support in the Assistant Teacher Program. *Australian Journal of Teacher Education*, 40(9), 157-175.
- Patton, M. (1980) *Qualitative Evaluation Methods*. Beverly Hills, CA: Sage.

- Prestridge, S. (2018). Categorising teachers' use of social media for their professional learning: A self-generating professional learning paradigm. *Computers & Education*.
- Prestridge, S. (2017) Examining the shaping of a teacher's pedagogical orientation for the use of technology. *Technology, Pedagogy and Education*. DOI: 10.1080/1475939X.2016.1258369.
- Prestridge, S. (2016) Conceptualising self-generating online teacher professional development. *Technology Pedagogy and Education*. DOI: 10.1080/1475939X.2016.1167113
- Prestridge S., Main K. (2018) Teachers as Drivers of Their Professional Learning Through Design Teams, Communities, and Networks. In: Voogt J., Knezek G., Christensen R., Lai KW. (eds) *Handbook of Information Technology in Primary and Secondary Education*. Springer International Handbooks of Education.
- Raphael, T., Vasquez, J., Fortune, A., Gavelek, J., & Au, K. (2014). Sociocultural approaches to professional development: Supporting sustainable school change, in L. Martin, S. Kragler, D., Quatroche, & K. Bauserman (Eds.). *Handbook of professional development in education: Successful models and practices, Prek-12*. Beaverton, OR: Guilford Publications. Chapter 8, 145-173.
- Ranieri, M., Manca, S., and Fini, A. (2012). Why (and how) do teachers engage in social networks? An exploratory study of professional use of Facebook and its implications for lifelong learning. *British Journal of Educational Technology*, 43(5), 754–769 doi:10.1111/j.14678535.2012.01356x
- Sang, G., Valcke, M., van Braak, J., Zhu, C., Tondeur, J., & Yu, K. (2012). Challenging science teachers' beliefs and practices through a video-case-based intervention in China's primary schools. *Asia-Pacific Journal of Teacher Education*, 40(4), 363-378.
- Shulman, L.S. (1987). *Knowledge and teaching: Foundations of the new reform*. Harvard Educational Review, 57(1), 1–22.
- Stein, M. K., Smith, M. S., & Silver, E. A. (1999). The development of professional developers: learning to assist teachers in new settings in new ways. *Harvard Educational Review*, 69(3), 237-269.
- Stevens, W. D., Kahne, J., & Cooper, L. (2006). Professional communities and instructional improvement practices: A study of small high schools in Chicago. Chicago: Consortium on Chicago School Research.
- Strauss, A. and Corbin, J. (1994) *Basics of Qualitative Research*. Newbury park, CA: Sage.
- Teddlie, C and Yu, F. (2007) Mixed method sampling: a typology with examples. *Journal of Mixed Methods Research*. Thousand Oaks, CA: Sage.

- Tondeur, J., Forkosh-Baruch, A., Prestridge, S., Albion, P., & Edirisinghe, S. (2016). Responding to challenges in teacher professional development for ICT integration in education. *Educational Technology and Society*, 19(3), 110-120.
- Tour, E. (2017). Teachers' personal learning networks (PLNs): exploring the nature of self-initiated professional learning online. *Literacy*, 5(1), 11-18
- Trust, T. (2012). Professional learning networks designed for teacher learning. *Journal of Digital Learning in Teacher Education*, 28(4), 133e138.
- Trust, T. (2016). New Model of Teacher Learning in an Online Network, *Journal of Research on Technology in Education*, 48:4, 290-305, DOI:10.1080/15391523.2016.1215169
- Trust, T., Krutka, D.G., & Carpenter, J.P. (2016). "Together we are better": Professional learning networks for teachers. *Computers & Education*, 102, 15-34. DOI:[10.1016/j.compedu.2016.06.007](https://doi.org/10.1016/j.compedu.2016.06.007)
- Tsiotakis, P., & Jimoyiannis, A. (2016). Critical factors towards analysing teachers' presence in on-line learning communities. *The Internet and Higher Education*, 28, 45-58.
- Veletsianos, G. (2011). Higher education scholars' participation and practices on Twitter. *Journal of Computer Assisted Learning*, 449, 336-349.
- Visser, R.D., Evering, L.C. & Barrett, D.E. (2014). Twitter for Teachers: The Implications of Twitter as a Self- Directed Professional Development Tool for K-12. *Teachers Journal of Research on Technology in Education*, 46(4), 396-413.
- Voogt, J., Pieters, J & Handelzalts, A. (2016). Teacher collaboration in curriculum design teams: effects, mechanisms, and conditions, *Educational Research and Evaluation*, DOI: 10.1080/13803611.2016.1247725
- Watson, G. (2001). Models of information technology teacher professional development that engage with teachers' hearts and minds. *Journal of Information Technology for Teacher Education*, 10(1-2), 179-190.
- Wenger, E., McDermott, R., & Snyder, W. (2002). Cultivating communities of practice. Cambridge, MA: Harvard Business Press
- Yin, R. (2014). *Case study research: Design and method* (5th edition). Thousand Oaks, CA: SAGE Publications.
- Zhang, S., Liu, Q., Chen, W., Wang, Q., & Huang Z. (2017). Interactive networks and social knowledge construction behavioural patterns in primary school teachers' online collaborative learning activities. *Computers & Education*, 104, 1-17. <http://dx.doi.org/10.1016/j.compedu.2016.10.011>

Table 1 Teacher participant details

Name	ICT Leadership role	Teaching Role
Australia		
Donna	Leader of E-Learning and Library Services	Secondary school teacher of Computing and Science
James	Online Specialist and peer coach	Teaching grade 5, specialized in physical education
Kate	Head of Contemporary Learning	Teaching Prep to year three
Kristy	Specialist ICT Teacher/ Curriculum integrator	Teaching computer skill and robotics at K to 12 school
June	Maker Space Literacy Specialist	Head of Library and year 5 Geography Teacher
Barbara	Ambassador for Tech companies, PD facilitator	Kindergarten teacher
Carol	PD provider	Teaching social study at a high school
Louise	PD mentor	Teaching grade 4
Shaun	Digital Innovator	Teaching grade 5
Tracey	PD at school and district level	Classroom teacher using Makey Makey and Project Based Learning
Brad	PD ICT facilitator, Researcher	School Advisor on ICT
Brian	Pedagogical ICT facilitator	Teaching trainer
Pia	Pedagogical ICT facilitator	ICT teacher for grade 5 and 6 at a secondary school
Tasha	Experienced Teacher- PD provider	Teaching Dutch for 3 rd -16 th grade

Terrance	Teacher trainer on ICT integration	Teaching remedial learning from 7-12 grade
----------	------------------------------------	--