Conceptualizing teachers’ professional learning with Web 2.0

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Introduction
Career long professional learning is widely recognized as an essential requirement for the modern teacher, in what is seen to be a complex, uncertain and rapidly changing global educational landscape (Clarke and Hollingsworth, 2002; Grundy and Robinson, 2004; Ashton and Newman, 2006). The need for teachers to understand and embrace the processes of change underpins educational reform initiatives worldwide and professional learning has been singled out for particular attention in achieving this goal.

If we want to encourage different approaches to teaching and learning, and new relationships between pupils and teachers, we need to understand the ways in which teachers come to learn, adapt and make such new approaches a reality. (Fisher et al., 2006 p. 2)

This paper conceptualizes how teachers’ professional learning might be supported and enhanced through the affordances of digital technologies and Web 2.0 technologies in particular. Web 2.0 is an emerging, experimental set of technologies and the research on enabling factors (affordances) and constraints for professional learning is limited (Redecker, 2008). Although there is a strong literature base that deals with teacher learning itself and an emerging literature base for thinking about learning with digital technologies, there is little that deals directly with teachers as learners with digital technologies (Fisher et al., 2006). Therefore the paper proposes an exploratory framework to illustrate how the elements which constitute professional learning might be supported and enhanced through the affordances of Web 2.0 technologies.

1. What is professional learning for teachers?
Rogoff defines learning through a socio-cultural lens as “the process of becoming someone who does something” (1993, p. 141). In doing something the learner engages in an activity and the act of participating, along with the tools which are used, change the people we are (Schneider and Evans, 2008). In this sense teacher learning is recognized as a particularly complex phenomena resistant to mechanistic formulas, descriptions, or standardization (Banks et al., 1999; Fisher et al., 2008). It is both a cognitive, individual process and also a socially constructed activity which is situated within specific contexts (Putnam and Borko, 2000). This is a necessarily simplified description of a more complex phenomena variously referred to as professional or teacher learning. These processes are represented visually by the inner ring in Figure 1 below. This overview of teacher learning concentrates on the following processes: experience, reflection, construction. These are analyzed within a wider ‘situated perspective’ of teacher learning that includes context, mediation, and collaboration (Anderson et al., 2000) (represented in the outer ring of Figure 1).
Take in Figure (No.1) Processes and contexts of teacher learning

**Figure 1. The processes of professional learning**

1.1 *The significance of experience*

Teachers, like most adults, learn from experience (Eraut, 1994) but the precise mechanisms which underpin this transaction are not entirely clear and remain contentious (Luckmann, 1996). Some consider learning by doing to be a precursor to learning through reflection (Kolb, 1984) but this is not universally accepted. For others practical wisdom is seen as the starting point for much professional learning (Hargreaves, 2000), and in this sense learning from experience is seen to be part of the process of learning to participate, a largely iterative and cyclical process.

Key questions:
- In what ways do teachers learn from their daily experiences?
- Can Web 2.0 technologies be used to facilitate the development of structures that tap into and capture these experiences (Schneider and Evans, 2008)?

1.2 *Critical reflection*

Critical reflection on work-based experience is recognized as a powerful tool facilitating professional learning, consisting of “a state of doubt, hesitation, perplexity, or mental difficulty, in which thinking originates” (Dewey, 1933, p. 12). Reflection offers the opportunity to transform tacit knowledge, often gained from experience about the world, into explicit knowledge which other professionals can share and learn from (Schon, 1991; Sternberg and Horvarth, 1999). However, recent commentators have criticized the original concept arguing it places too much reliance on the role of the individual at the expense of the group or team they are working within. Boud has developed the concept of ‘productive reflection’ which addresses some of these concerns and “engages with the context and purpose of work and, most importantly, with the imperative that reflection in such settings cannot be an individual act if it is to influence work that takes place with others” (2010, p. 33). These arguments resonant with many of the processes of professional learning, and the affordances of Web 2.0 technologies outlined below. They suggest critical reflection has the potential to lead to significant learning by teachers when it is augmented by the observations of colleagues and mentors and supported through the appropriate use of collaborative technologies (Moon, 2008).

Key questions:
- What should be the balance between personal and collective critical reflection to support professional learning?
- Which specific affordances of Web 2.0 technologies are most likely to encourage teachers to undertake both individual and socially mediated critical reflection?

1.3 *Knowledge construction*
Through a process of active construction, rather than passive transmission of content, teachers learn to construct, develop and adapt their knowledge bases to meet the challenges of a changing landscape (Jonassen et al., 1999; Dalgarno, 2001; Burbank and Kauchak, 2003). In constructing their learning they develop and extend a variety of different knowledge domains. This involves developing their pedagogical content knowledge (PCK) which is a complex mixture of procedural and declarative knowledge, enabling them to successfully render content into understanding (Shulman, 1987). This is a process teachers undertake partly in their heads (cognitively) but also through social enactment with other colleagues and professionals as part of a learning community (Lave and Wenger, 1991). Huberman describes how the process begins when individual teachers ‘tinker’ with a new technique or modify an existing approach within their own teaching context and then share the outcomes with colleagues where it “becomes more systematic, more collective and explicitly managed…and transformed into knowledge creation” (cited by Hargreaves, 2000, p. 231). More recently the process has been adapted to embrace the challenges faced by educators with technology. Technological pedagogical content knowledge (TPCK) has been identified as a significant new knowledge base teachers need to learn and construct in order to maximize the opportunities for learning with technology (Mishra and Koehler, 2008; Koeller and Mishra, 2009).

Key questions:
- How far do teachers perceive themselves to be knowledge constructors, rather than knowledge consumers?
- In what ways can Web 2.0 technologies such as wikis and 3-D virtual learning environments (3-D VLEs) encourage teachers to become knowledge constructors?
- How can Web 2.0 technologies underpin and support individual and collective knowledge building activities?

2. The context of teacher learning: a situated perspective
The situated perspective, rooted in socio-cultural traditions, emphasizes the importance of context or situation in relation to teacher learning (Putnam and Borko, 2000). This is represented by the outer ring in Figure 1.

2.1. Teacher learning is context sensitive
The situative perspective emphasizes that learning is closely associated with the specific contexts in which it occurs, although these are not always spatially bound (Brown et al., 1989). Contexts for teacher learning are likely to vary according to the nature of the learning taking place, and some contexts likely will be more conducive to certain types of teacher learning than others. In some instances, for example, the ideal contexts for teacher learning will be work based where the purpose might be to simulate authentic task-based learning in an experiential environment. But for other types of learning removing teachers from their work places may be preferable in order to facilitate thinking and learning that is not constrained by the dominant ‘discourse communities’ in which they practice.
Teachers’ knowledge is situated, but this truism creates a puzzle for reform. Through what activities and situations do teachers learn new practices that may not be routinely reinforced in the work setting? (Sykes and Bird, 1992, p. 501)

Web 2.0 technologies such as 3-D VLEs and internet telephony (e.g. Skype and Google Wave) promise to liberate teachers from their physical constraints by generating a multiplicity of alternative spatial dimensions in which various types of professional learning can be enacted (Dalgarno and Lee, 2010). The challenge lies in carefully correlating the different types of professional learning with the alternative environments which Web 2.0 can render.

Key questions:
- What types of contexts are likely to be most conducive for teachers’ professional learning?
- How can Web 2.0 technologies be used most effectively to generate learning contexts which would otherwise be difficult, or impossible to create for teacher learning?

2.2 The social and collaborative nature of teacher learning

Membership of specific discourse communities (Putnam and Borko, 2000) and enculturation into communities of practice (Lave and Wenger, 1991) are both powerful forms of social learning for teachers. Such activity extends beyond mutual encouragement with other colleagues and recognizes the role other individuals and groups can play, both in what is learned and how it is learned (Resnick, 1991; Aubusson et al., 2007). Rogoff describes the process as one of “participatory appropriation” in which both the individual and the community are transformed by participation that dissolves the boundary separating participants from their context (1993, p. 153). As Scheinder and Evans put it: “We are what we participate in” (2008, np). But teachers are also nomadic, itinerant individuals, often working alone rather than as part of a team, and this mitigates against their membership of such groups (Aubusson et al., 2009). Additionally, discourse communities and communities of practice are recognized as having both the influence to generate radical alternative perspectives for their members and to maintain the status quo by enculturating new members into ‘traditional school activities and ways of thinking’ (Cohen, 1989, cited by Putnam and Borko, 2000, p. 8). The ethos and culture of these communities are therefore vital barometers in determining whether teacher learning will be progressive and outward looking, or essentially conservative and resistant to change.

Key questions:
- What specific forms of social community engender deep and critical forms of participation and learning?
- Can Web 2.0 technologies be used to mitigate against the nomadic and individualistic tendencies of teachers to support social and collaborative professional learning?

2.3 The distributed nature of teacher learning
The socio-cultural perspective on learning argues that learning is not entirely situated in 
the minds of individuals, but rather it is distributed across people, groups and indeed 
objects, artifacts and entire networks (Wertsch, 1991). Whilst schools tend to focus 
heavily on a more individual conception of cognition, Web 2.0 promises to offer support 
for a more distributed view of cognition, particularly through the mediating impact of 
tools and artefacts. Artefacts are defined as tools and symbols which human beings have 
developed over time enabling them to undertake complex tasks in ways which would not 
otherwise be possible. They are tools which liberate humans from working entirely in 
their own mind and in doing so they enable us to off load some of our cognitive load, for 
example in the form of language and written data. Web 2.0 technologies are mediating 
tools which promise to support teacher learning and are the focus of the next section of 
the article.

Key questions:
- How can teacher learning be supported through distributed networks and 
  mediating objects/tools?
- Which aspects and affordances of Web 2.0 technologies are capable and suitable 
  of mediating professional learning?

3. The affordances of Web 2.0 technologies
Web 2.0 is an invented term used to describe a vast range of online services, tools and 
applications which are generally freely available online (Solomon and Schrum, 2007). 
User activity is characterized by participation, collaboration and construction, rather than 
passive consumption. Technically Web 2.0 is not a radical departure from the original 
Internet (sometimes referred to as Web 1.0) but it does realize a number of aspirations 
which users have long desired. Where, for example, Web 1.0 is essentially a ‘read-only’ 
medium, Web 2.0 is referred to as a ‘read-write’ medium since users are empowered to 
develop and contribute their own digital productions (Thompson, 2007).

Crook et al. describe Web 2.0 as a technology that “celebrates and builds 
community. It facilitates participation and it resources debate” (2008, p. 7). In defining 
the underlying characteristics of Web 2.0 they identify five key features or benefits. 
These are briefly explained below with reference to their potential for supporting and 
enhancing teachers’ professional learning which has been described above.

3.1 User-generated publishing
Web 2.0 technologies invite users to construct and publish content in ways that were 
previously costly or impossible. Blogs and wikis enable users to easily edit, re-purpose 
and publish text and media-rich resources (e.g. video) to the Internet. They combine 
many of the functions of the traditional publishing house in providing both a platform for 
the production of ideas and a channel for direct publication, generally at little or no cost 
to the author/s (Wheeler, 2009).

Linked to social software networks such as FaceBook, MySpace and LinkedIn, 
blogs and wikis offer new opportunities for teachers to develop and share their own 
professional learning. Teachers are capable of being creators rather than simply 
consumers of knowledge (Freeman, 1998). These services provide the means for teachers 
to share, critique and act upon their representations of the world, accessing alternative
perspectives which would not be as readily available in the analogue world (Laurillard, 2002). These affordances provide the opportunity for teachers to overcome the isolationism and parochial mindsets partly imposed upon them by the nomadic and itinerant nature of their working contexts. These opportunities suggest teachers need to be flexible co-creators rather than ‘self-sufficient’ producers; comfortable collaborators working in flat, rather than hierarchical structures and self-critical good communicators (Redecker, 2008, p. 8).

3.2 Collaboration, participation and sharing

Web 2.0 offers educators a set of tools to support forms of learning that can be more strongly collaborative and more oriented to the building of classroom communities. (Crook et al., 2008, p. 28)

These principles promise far more than just the dissemination of content as they imply a moral and ethical position which is community orientated rather than individual. Web 2.0 is predicated on an underlying “architecture of participation” (O’Reilly, 2004) which promises to get better the more people use it (Thompson, 2007, p. 1). Whether through a collaborative wiki, a social networking site, or an 3-D VLE such as Second Life, collaboration and participation are the defining characteristics. The key to success in these environments is the vitality and participation of the community. Web 2.0 thrives because of participation and the willingness of users to work together.

The use of freely available open source content and licensing agreements, such as Creative Commons, facilitates a communitarian ethos, and services like photo sharing (e.g. Flickr and Picasa), video sharing (e.g. YouTube) and document sharing (e.g. Google Docs) are the means by which it is enacted both individually and in groups. Social bookmarking and personalized tagging applications such as Delicious and Digg are also examples of this feature. Tags or folksonomies can incorporate rich annotations and metadata enabling fellow users to identify and build upon socially valuable artefacts shared by the community.

These features promise to change the ways in which teachers search for, create and share content, both for teaching purposes and for their own learning. But they also challenge some of the entrenched practices and behaviors which face teachers including their reticence to share resources and ideas, and their insistence on producing their own unique resources rather than adapting existing ones. For teacher learning these features could be very valuable but this will depend on whether the underlying culture within a community of practice is orientated towards the sharing or hoarding of resources and ideas.

3.3 Re-purposing

Closely linked to notions of sharing and collaboration is the concept of re-purposing or re-mixing of content which builds upon the emerging open education resource (OER) movement and the simultaneous development of open licensing agreement. By providing access to the raw data itself (e.g. the source code), users are actively encouraged to take resources, re-edit and re-package them in new formats, and share them with the wider community.
3.4 Multi-literacies
In the post-modern world, literacy is no longer associated exclusively with the printed word or the ability to read, write, and produce text. The term is now seen to embrace other means of representation including images, sounds, and moving image media (Kress, 2003). Schools and teachers across the world are beginning to explore the potential of Web 2.0 services which promote or enable multi-literacies to be developed in the classroom, such as YouTube and FlickR. How far these changes in definition have permeated the practices of learners, and teachers in particular, is not yet clear. They are potential vehicles for alternative approaches to teacher learning by, for example, enabling teachers to use multimedia evidence and formats to report their learning as in the Video Papers project (Olivero and Sutherland, 2004). But equally, they pose a challenge for teachers unconvinced by the rhetoric and still committed to a largely text-based conceptualization of literacy.

3.5 Inquiry and research
In much the same way that Web 2.0 technologies have modified how students undertake research and inquiry, so they promise to radically alter how teachers think about the processes along with the resulting organization and classification of knowledge itself (Crook et al., 2008). These are not neutral or value-free technologies. They imply significant shifts in thinking about the production and nature of knowledge and the processes by which knowledge is validated and authenticated (Zhang, 2009). Shifts from bounded conceptions of knowledge (e.g. codified subject knowledge) to personalized versions and from static to animated mechanisms of engaging with knowledge challenge teacher learning where Web 2.0 technologies are employed. Freeman (1998) has described teachers as “consumers, not producers of knowledge” but in facilitating the shifts outlined above teachers will also need to confront and overcome many challenges, not least their existing epistemological constructs and schemas.

4. Web 2.0 and teachers’ professional learning
The section above indicates how Web 2.0 might play a significant role in affording new opportunities for learners “disrupting traditional learning and teaching patterns, giving rise to new and innovative ways of acquiring and managing knowledge” (Redecker, 2008, p. 7). But much of the current research investigates how teachers can be better prepared to use such technologies in their teaching rather than as an integral part of their own learning (Downes, 2004; Fisher et al., 2006). Figure 2 illustrates an exploratory framework for mapping the varieties of teacher learning (identified in section 2) with the features and affordances of Web 2.0 technologies (described in section 3).

Technologies themselves are not responsible directly for learning, but they can
“afford certain learning tasks that themselves may result in learning or give rise
to certain learning benefits” (Dalgarno and Lee, 2010, p. 17). Hence it is useful to
correlate particular kinds of Web 2.0 affordances and learning tasks with the
opportunities for professional learning they might offer. In this final section of the paper
three scenarios are mapped against the framework to illustrate how Web 2.0 technologies
might facilitate particular types of professional learning opportunities in this way. They
draw upon the initial findings of a research case study in the north of England where
approximately 40 teachers are working with the author in a work-based, accredited,
action-research project focused on Web 2.0 technologies and pedagogical transformation.

Take in Figure 2. Affordances of Web 2.0 technologies and teacher learning

Figure 2. Affordances of Web 2.0 technologies and teacher learning

4.1 Teacher learning and knowledge construction: wikis
This article has highlighted both the constructed and collaborative nature of teachers’
professional learning which are well served by many of the affordances of Web 2.0, in
particular wikis.

In this case study all of the teachers have developed their personal wiki page
within a collaborative wiki environment for professional learning (WetPaint). They are
couraged to work in learning sets to construct their own knowledge on a particular
pedagogical problem and share different perspectives around these representations. The
wiki offers an alternative context for learning in which the teacher is free from the
immediacy of the school environment (e.g. staffroom) and able to think and articulate
ideas which may be difficult in other places and spaces.

Knowledge construction, note Schneider and Evans, “requires that participants
have serendipitous, spontaneous, and improvisational access to each other and to relevant
expertise.” They go on to argue for the need for “ample opportunities for participants to
observe each other in some way and be involved in hands-on activities” (2008, p. 2).
Active wiki building appears to be well placed as a teacher learning device to promote
these opportunities. The process enables teachers to personally construct their own
artefacts without having to wait for the intervention of a web specialist or outside agent.
In doing so they are modeling the processes that Schneider and Evans talk about and are
seen to be doing so by their colleagues.

4.2 Teacher learning through reflection & collaboration: VoiceThread
VoiceThread is one of the emerging “disruptive Web 2.0 technologies” (Redecker, 2008)
which supports rich media forms of communication and reflection within a collaborative
knowledge-building paradigm. It is described by its creators as a “tool for having
conversations around media” and like many of the most recent conversational tools (e.g.
Skype) it enables users to communicate in a multimodal fashion, in addition to traditional
text conversations, thus enabling teachers to enact their learning in multi-literate
modalities. In this sense it overcomes some of the limitations of blogs and wikis which
are still essentially text based. Teachers in the case study are currently appropriating
Voicethread to support and develop alternative perspectives and modes of communication for their students. In doing so it is evident the tool also serves to underpin their own professional learning with a particular focus on reflection, collaborative knowledge building and the sharing of alternative perspectives. This paper argues that teachers learn in particular contexts and these need to be aligned carefully with different types of professional learning activities. Critical reflection is a type of professional learning activity that Web 2.0 applications like VoiceThread can support and enhance in ways that traditional analogue techniques (e.g. journals) can not match. For example, VoiceThread enables users to post their own reflections in traditional formats (text) but also augments this with video and audio communications. The opportunity for multimedia feedback from other members of the community appears to encourage a greater depth of participation than is evident in traditional blog entries. Reflection becomes a multi-dimensional conversation with other professionals rather than the solitary activity which typifies many blogs (Burden and Atkinson, 2008).

4.3 Teacher learning through experience and construction: 3-D immersive worlds

3-D VLEs create alternative learning spaces which provide participants with “the ability to explore, construct and manipulate virtual objects, structures and metaphorical representations of ideas” (Dalgarno and Lee, 2010, p. 11). They identify five specific affordances which 3-D VLEs might generate for learners:

- spatial knowledge representation
- experiential learning
- engagement
- contextual knowledge
- collaborative learning

Any one of these affordances might generate a learning task which correlates with the aspects of professional learning identified in this article (cf. Figure 2), but this scenario focuses on the possibilities for experiential learning. A small sub-set of the teachers in the case study are currently exploring the potential of virtual worlds such as Second Life and Second Places to host alternative learning experiences for their students in subject disciplines such as art, English and mathematics. The learning process for these individuals is itself highly experiential as they are encouraged to role play student learners embarking on their first journeys into the immersive worlds which have been created for them. In one example, teachers are exploring a fictional island based on the novel Lord of the Flies which is a set textbook for English students. The ‘island’ provides a ‘safe’ environment in which the inhabitants can experiment with different identities and personas in order to better understand characterization in the novel itself. By removing themselves from the traditional classroom to an alternative social space, learners (teachers in this case) are able to experience the novel in ways which are more engaging and higher in “representational fidelity” (Hedberg and Alexander, 1994).

In undertaking these roles teachers have experienced a range of different learning processes in a variety of different contexts. In an earlier section of the article it was noted that context is a crucial ingredient in the professional learning process and some contexts are likely to be more conducive for professional learning than others. Working in 3-D
VLEs is likely to challenge teachers but may also result in the discovery of alternative learning spaces conducive to particular learning processes.

5. Conclusions

This paper has outlined the various processes which underpin teacher learning within a broadly situative perspective based on socio-cultural views and theories of learning. Five key features or affordances of Web 2.0 technologies are identified as being particularly valuable and harmonious with teacher learning even though most of these applications were not designed originally for schools or even education in the wider sense:

- User-generated publishing
- Collaboration, participation and sharing
- Re-purposing
- Multi-literacies
- Inquiry and research

Each of these affordances offers potential support for particular kinds of professional learning in differing contexts but the precise relationship between these variables is largely uncharted and still problematic. The framework which has been suggested (Figure 2) is a starting point for charting the match between the various Web 2.0 tools with their associated affordances and the elements of professional learning which accumulated wisdom indicates are most effective. This is an exploratory framework which invites further empirical investigation along the lines set out in the case studies which have been described.

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