A Community of Practice for Early Career Biology Teachers: Social Networking and Digital Technologies

Jacinta C. Duncan & Paul D. Chandler,

The University of Melbourne

The challenge for science teacher educators is to develop pedagogies and employ technologies which embrace "communities of practice" as core to both science practice and teacher learning. In this presentation, we consider early career biology teachers – those who are presumably of the "net generation", but whose engagement with both online communities and communities of practice in their fields of teaching is surprisingly limited. We present pedagogical practices (and online tools) specifically designed to foster a community of practice and the collaborative creation of a multimodal e-learning resource. These represent our first steps towards reconceptualising 'method' studies as a longitudinal community of practice rather than a 'one shot wonder'.

Some realities of Biology Teacher Candidates

Conversations in scholarship of the discipline

The practice of teaching should never be an isolating experience. It should be one of professional engagement where we embrace a culture of sharing information, and discussing practice. A survey of 52 Teacher Candidates (TCs) mid-way through their Biology Method course at The University of Melbourne found that interactions with educators and peers beyond the classroom was minimal with most dialogue in scholarship of the discipline taking place between students and their friends and family. The use of the subject discussion board established on the Learning Management System (LMS) to promote dialogue between peers and experts was not an effective tool for this purpose as posts open individually resulting in posting of discrete comments seldom read by peers for reflection and refining of ideas and attitudes. The LMS site was viewed as a hierarchical means of disseminating information rather than a space to share resources or discuss issues. Given that informal learning through conversations and networking is believed to be a significant aspect of our learning experience (Siemens, 2004), a new approach was required to encourage sharing, reflection and refinement of educational ideas amongst peers and experienced educators beyond the classroom. This approach would ideally allow for

an open running dialogue such as the conversational platforms offered by social networking sites.

ICT in education practice

The Digital Education Revolution initiative launched by the Labor Government in 2008 (DER strategic plan, 2008) has resulted in improvements in student access to technologies and improved ICT infrastructure in schools across Australia. But, as this 'access' digital divide narrows, concerns emerge of a growing digital divide between teachers and students. Australian youth (9 – 16 year olds) are becoming more prolific in their use of digital technologies at home (Hather, 2010; Innovative Teaching and Learning Research Report, 2011) fueling pressures for educators to harness digital tools in their practice – the challenge here being to rethink pedagogies to repurpose digital tools for innovative practice rather than using them to teach at students. The National Professional Standards for graduating teachers (Australian Institute for Teaching and School Leadership, 2011) require graduate teachers to have proficiency in repurposing digital tools to expand curriculum learning opportunities; to employ ICT resources that engage students in learning; and to understand the relevant issues and strategies available to support safe, responsible and ethical use of ICT in learning and teaching. A survey of the ICT proficiency of our Biology TC cohort explored their current practices with online technologies revealing a very low presence on the web beyond an overwhelming daily use of email and Facebook for social communication. Very few students were using twitter, blogs, wikis and other Web 2.0 tools to inform their practice or to establish a professional presence online. Further, TCs reported on observing little use of ICT in Biology classes beyond the use of PowerPoint for lecture style delivery of content.

Throughout the first semester of their Biology method course TCs were introduced to a number of digital resources designed to enhance learning opportunities for Senior Biology students using an authentic learner centered approach. While this helped TCs to realize affordances of digital technologies to Biology education it did not generate a culture of thinking around how they can apply digital technologies to resource design in their practice. To adequately prepare teachers to integrate ICT into their practice Mishra and Koehler (2006) argue they need exposure to ICT experiences that enable them to recognize the potential and problems of technologies in order to successfully apply them to education practice. Introducing a learning environment that harnesses the power of Web 2.0 tools for communication in scholarship in the discipline; and that immerses TCs in the collaborative creation of digital learning resources using the learning technology by design approach of Mishra and Koehler (2006) should encourage sustained inquiry and refinement of ideas in the context of social constructivism (Vygotsky, 1978).

Pedagogical Content Knowledge

Repurposing digital technologies to teaching Biology requires Pedagogical Content Knowledge (PCK), an understanding of "the most useful forms of representation of ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations" (Shulman, 1986) that facilitate the learning of specific topics. Drawing on Brown's (2006) distinction of the explicit and tacit dualities of knowledge it can be said that the pursuit of PCK is an ongoing process of

learning the explicit knowledge (the know what) of the practice and learning the more tacit knowledge of our practice (the know-how). Brown elaborates that

> *since the tacit lives in action, it comes alive in and through doing things, in participation with each other in the world. As a consequence, tacit knowledge can be distributed among people as a shared understanding that emerges from working together (Brown, 2006).*

Fostering a mindset of iterative development of PCK warrants more focus on transferring the tacit knowledge in method classes. Re-imagining the method class as a Community of Practice (CoP) promotes communication in the scholarship of the discipline and shared knowledge creation through interactions with educational ideas in collaborative practice.

Communities of practice

Communities of Practice involve dynamic interactions between participants who share experiences, stories, and tools around a common domain of interest and, in doing so, build relationships of trust and develop shared practice (Wenger, 2006). Successful teacher learning communities involve participants in conversations that prompt them to question their assumptions about good practice and consider new methodologies (McLaughlin and Talbert, 2001). They allow participants to "engage in powerful learning that adds to their knowledge base and repertoire of technical skills to increase effectiveness" (Hord and Sommers, 2008, p 19). With this in mind, a framework for a CoP for early career biology teachers (Biology TCs) was designed to cater for the dualities of participation and reification (Wenger, 1998) and the dualities of explicit and tacit knowledge (Brown, 2006) adapted from an approach adopted by Kimble and Hildreth (2005). This framework (figure 1) applies a situated learning approach where "learning is seen to be embedded in social interactions and it can take the form of a kind of apprenticeship, as newcomers observe and gradually come to participate in particular social practices" (Buckingham, 2008, p. 16). It recognizes that "members benefit from sharing expertise and the knowledge constructed through collaboration is richer than that which members can construct on their own." (Butler et al, 2004, in Dettori et al, 2006, p. 398). Participants work collaboratively to negotiate meaning and produce artifacts, resources and stories, to reify their practice.
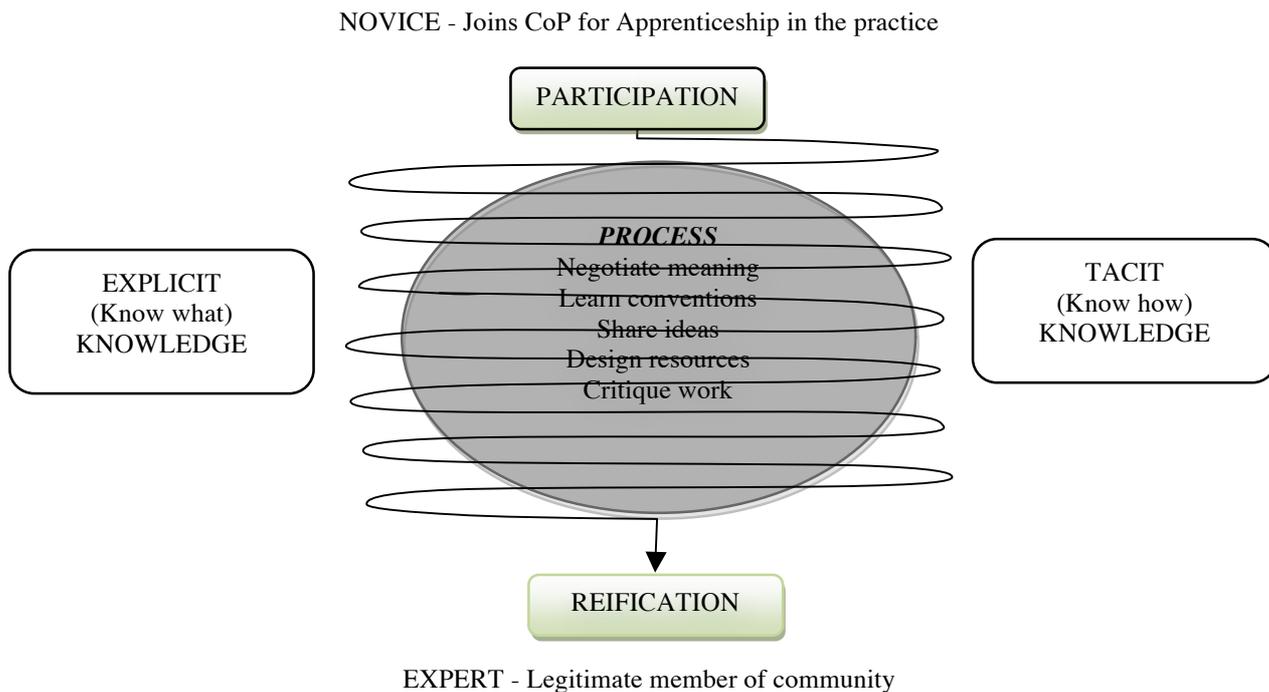
NOVICE - Joins CoP for Apprenticeship in the practice

Figure 1: A novice acquires expertise in the practice of biology education through participation in a CoP where they are exposed to the interplay between explicit and tacit knowledge through interaction with community members. This is an iterative process as the attainment of expertise is a lifelong learning process.

We explicitly identify this community as a closed and bounded one; the objective is to foster communication amongst a particular cohort of Biology TCs with the expectation that they will be engaged. Issues of whether the approaches used would be suitable for Biology educators (pre-service or in-service) in general, or the extent to which membership of this particular community of practice is separable from other communities of practice (such as other education studies or inservice teacher programs) have not been explored – our focus in this paper is to describe what was attempted in relation to the particulars of a specific course of study.

The design of this CoP provides for scholarly discourse in the discipline, imparting explicit knowledge and socially constructing knowledge through engaging in planning, enacting, and reflecting on resource developmnet where members access the tacit knowledge of the practice. Practices and their perceived outcomes are detailed in table 1.

Table 1: Community practices and outcomes of participation

Practice	Outcomes
Participation in Edmodo, a private online social network for educators	• Modeling the use of Web 2.0 tools for education purposes • Develop trust and facilitate participation in the community through provision of a safe arena for exploring identity and personal relationships • Develop a shared identity in the practice of Biology Education • Stimulate thinking and spread innovations • Collateral learning by sharing and developing on observations and opinions of peers and forming enduring attitudes • Interaction with experts beyond the classroom • Always-on discussion forums provide for learning anywhere, anytime using "tethering technologies" (Turkle, 2008) such as smart phones • Enhance scholarship in the discipline
Face-to-face and online collaborative practice: Using a learning technology by design approach to collaboratively repurpose digital technologies to the design of resources for Senior Biology	• Develop PCK through transfer of explicit and tacit knowledge • Stimulate discussion, problem solving and innovation • Participate in constructive dialogue for creating shared voice and vision • Induced to reflect on other peoples opinions and points of view • Iterative feedback on ideas and works in process • Practice collaborative skills of negotiating objectives and strategies and accounting for the opinions of others • Development of shared scholarly practices through critical engagement with peers' contributions • A diversity of perspectives strengthens social creativity • Practice identifying and utilizing the affordances inherent in representations for creating and imparting meaning • Focus on form and function of representations for scaffolding and assessing student understanding • Catalyst for participation and reification of knowledge
Increasing communication in the discipline through developing and blogging an informed professional voice	• Modeling the use of Web 2.0 tools for educational purposes • Reporting on thoughts in the public domain encourages deep reflection • Engage with and respond to the work of peers • Practice self-promotion and engagement in the broader education community • Contribute to the economy of knowledge production and dissemination • Develop shared language and practices in the scholarly discipline • Develop and refine professional informed opinions

In addition to these being key strategies for building a professional community, it is intended that use of the various technologies will have a flow-on effect in terms of how various technologies might be used in the (secondary) classroom. More

specifically, to demonstrate the re-purposing of Web 2.0 technologies for the Biology education curriculum to encourage the re-purposing of Web 2.0 technologies in the secondary curriculum.

The technology

Edmodo

Edmodo is described as a free, secure, social learning platform for teachers, students, schools and districts. Appearing very much like facebook to the use, Edmodo provides teachers and students with a secure and easy way to post classroom materials, share links and videos, access assessment tasks and co-ordinate activities using a calendar.

Blogging

> Blogs are Web pages, or Web sites consisting of many pages. Their reverse-chronological structure implies a different rhetorical structure than a Web page, which as no inherent timeliness. Blogs are devoted to frequent updates … readers can comment on most blogs, building and layering content to individual posts over time. The simplicity of creating and updating blogs empower readers to write. The practice of blogging … [has grown] over time to elicit a new form of audience … consisting on of bloggers commenting on each other, fact checking posts and collaborating on projects
>
> *(Anderson, 2008, p. 150)*

In this project, the blogging platform posterous (http://www.posterous.com) was used, and teacher candidates participated in two blog sites:

- a personal, professional blog; it was expected that each teacher candidate would both set up such a blog together with reading and commenting on other's blogs
- a group blog, which was the platform for mounting and describing the group project which included the construction of digital resources for the Biology curriculum

Posterous was chosen for several reasons. Firstly, because users can create several individual or group blogs using a single login. Secondly, because it facilitates a group blog. Thirdly, the user can designate whether the blog is public or private (so that in the formative stages, it is not 'public to the world'). Finally, posterous is regarded as being quite leading edge and facilitating 'mobile blogging' by using mobile phones or other portable devices in addition to a web-based interface. (It is not known to what extent the mobile blogging facility was actually used, however.) Posterous proved to be a generally suitable framework for the task, although it is prone to presenting quite differently when using different browsers, some features working well under one browser and not under another, which was met with some level of frustration. Posterous is also not the ideal location for mounting digital resources (eg document with live links to other documents which also need to be uploaded) as the links are absolute rather than relative. In short, it is better to upload to a file repository and then link from posterous.

Digital objects

The digital objects produced by the teacher candidates include:
- animations/movies created using PowerPoint/iSpring (www.ispringsolutions.com)
- videos or video mash-ups produced using MovieMaker
- mindmaps or charts produced using Spicynodes (www.spicynodes.org)
- multimedia quizzes produced using Hot Potatoes (hotpot.uvic.ca)
- videos produced using smart phones
- diagrams or flowcharts produced in gliffy (www.gliffy.com)
- simulations produced in Flash
- visualisations produced in the macromolecular structure viewer (www.ncbi.nlm.nih.gov/Structure/CN3D/cn3d.shtml)
- podcasts produced using Audacity (audacity.sourceforge.net)
- presentations in Prezzi (www.prezi.com)
- visualisations produced using Biology Workbench (www.ngbw.org)

Reflection on methodological considerations

What would be the indicators that our use of various technologies and pedagogical approaches have been successful? Indicators of success would include the following:
- TCs showing increased confidence in discussions about education with peers and the lecturer
- TCs showing increased level of 'connection' between one another and the lecturer
- The developing PCK and ways of 'thinking like a teacher' being visible
- TCs identifying ways of being more creative
- Increased engagement and confidence with relevant technologies

Laudable as these objectives may be, it is quite difficult to capture data which would confirm progress on any these – and this is one methodological issue. Communities of practice is good theory, but finding ways of exploring questions such as "in what ways is the cohort increasingly functioning as a community of practice?" and "what learning outcomes can be attributed to the intentional formation of a community of practice?" are not straightforward to explore.

We may further wonder about the 'meta awareness' practices of the community of practice. In what ways did the community gather data about itself and feed this back to the community itself? To what extent did TCs learn from one another or take a meta-analytic view of the community and its formation – or were they actually more focused on task completion.

In essence, we can only conclusively report that certain areas of concern were identified, and theoretically well-grounded approaches have been put into place to address those. Out of that experience, quite important methodological issues pertaining to the effectiveness of the intervention can be identified; ones which must be addressed ahead of further developments of this work.

Conclusion

This paper has presented a model for re-imagining the Biology method of study as a Community of Practice. The variety of practices introduced to promote participation to refine PCK, shift TCs from users to designers of digital teaching resources, and increase scholarship in the discipline warrants further investigation to determine their impact on current and future practice. While a significant proportion of the cohort engaged in all components of the CoP, becoming legitimate members, the issue of 'lurkers', those who follow the activity but fail to participate would need to be explored further. A powerful aspect of this model was being able to visualize the thinking and pedagogies enacted by TCs allowing the lecturer and peers to guide and refine the practices of participants through negotiated practice, and allowing the lecturer to notice elements of practice that TCs find challenging and to refine teaching strategies in response. This pilot study will inform future research approaches into the design of communities of practice for early-career Science teachers, and has identified some of the difficulties associated with measuring or monitoring the transition of a 'group of people' into a 'community of practice'.

References

Alexander, B. (2008). Web 2.0 and Emergent Multiliteracies. *Theory into Practice*, *47*(2), 150-160.

Australian Institute for Teaching and School Leadership (2011) National Professional Standards for Teachers: February 2011. Retrieved October 18th, 2011, from http://www.teacherstandards.aitsl.edu.au/Static/docs/aitsl_national_professional_standards_for_teachers_240611.pdf

Brown, S. (2006). Growing up digital: How the Web changes work, education, and the ways people learn. *Journal of the United States Distance Learning Association. 16(2)*. Retrieved August 15, 2011, from http://www.usdla.org/html/journal/FEB02_Issue/article01.html

Buckingham, D. (2008). Introducing identity. Youth, Identity and Digital Media. Edited by David Buckingham. Cambridge, MA: The MIT Press p. 1 – 24

Dettori, G., Giannetti, T., and Persico, D. (2006). SRL in online cooperative learning: Implications for pre-service teacher training. *European Journal of Education, 43*(3), 397 – 414.

Fitzgerald, R., and Steele, J. (2008). Digital learning communities: investigating the application of social software to support networked learning (CG6-36). Retrieved September 20, 2011, from the Australian Learning and Teaching Council website, http://www.altc.edu.au/resource-digital-learning-communities-canberra-2009

Green, L., Brady, D., Olafsson, K., Hartley, J., Lumby, C. (2011) Risks and safety for Australian children on the internet: Full findings from the AU Kids Online survery of 9 – 16 year olds and their parents. ARC Center of Excellence for Creative Industries and Innovation. Retrieved November 25, 2011 from Australian Policy Online at http://apo.org.au/research/risks-and-safety-australian-children-internet

Hord, S., and Sommers, W. (2008). Leading Professional Learning Communities: Voices from Research and Practice. Corwin Press.

Kimble, C., and Hildreth, P. (2005). Dualities, distributed communities of practice and knowledge management. *Journal of Knowledge Management, 9 (4):* 102 – 113

McLaughlin, M., and Talbert, J. (2001). Professional Communities: and the work of high school teaching. The University of Chicago Press, Chicago

Mishra, P., and Koehler, M. (2006). Technological Pedagogical Content Knowledge: A Framework for teacher Knowledge. *Teachers College Record, 108(6):* 1017 - 1054

Mishra, P., and Koehler, M. (2009). Too cool for school? No way! Using the TPACK framework: you can have your hot tools and teach with them, too. *Learning and Leading with Technology, 36(7)*: 14 – 18

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15 (2)*: 4 – 14

Siemens, G. (2004). Connectivism: A learning theory for the digital age. Retrieved September 10, 2011, from elearnspace: everything learning website, http://www.elearnspace.org/Articles/connectivism.htm

Turkle, S. (2008). Always-on/Always-on-you: The tethered self. Retrieved August 20, 2011, from http://web.mit.edu/sturkle/www/pdfsforstwebpage/ST_Always%20On.pdf

Vygotsky, L., (1978) Mind and society: The development of higher mental processes. Cambridge, MA: Harvard University Press

Wenger, E. (1998) Communities of practice: Learning, meaning and identity. Cambridge: Cambridge University Press.