How to Strengthen Teacher Education Experiences using Web 2.0 Technologies as Instruments to Enhance Learning

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Abstract
This article provides insights into the use of Web 2.0 technologies from a personal perspective of an Australian education academic preparing the next generation of teachers at a higher education institution in Victoria Australia in digital and design technologies. The presentation will provide examples of the use of Web 2.0 technologies used by students to create, build, reflect, play and collaborate across a range of higher education subjects on offer for pre-service teachers that build knowledge, promote active and engaged learning, increase learner independence and tailor such learning to the individual needs of learners for the twenty first century.
There are implications for any higher education institution involved with pre-service teachers in the teaching of a range of curriculum and the use of Web 2.0 technologies.

Keywords: Information and Communication Technologies (ICT), teachers, higher education, pre-service teachers (students training to be teachers), Science and Mathematics, Web 2.0 technologies, Challenge Based Learning, design principles

Twenty First Century Education

Education is facing one of the largest transformations with globalization, knowledge economies and technical changes reshaping the world. As Fitzgerald (2014) states: "Pushing universities to seek new ways to reinvent themselves" (p.7). Education in the twenty first century is about working with people and by people, supporting the development of personalised learning with innovations associated with inventing new teaching practices using up-to-date technologies in creative ways. There are co-construction pathways between learners and educators developing ambitious and radical innovative environments and this to me is the future for all education systems worldwide. The emphasis is upon transferable skills where the learners are demanding improved access and outcomes and where the world economies are demanding new twenty first century skills.

This changing digital landscape needs to build on the increasing and wide ranging experiences in the use of digital technologies where higher educational institutions are obliged to focus upon and provide students with technology integration skills. As Banas and York (2014) state, "should focus not only on developing preservice teachers' technology integration skills, but also provide them with the skills to navigate new technologies" (p.741).

These fundamental innovative changes occurring in the learning experiences offered by educational settings can be seen in how the modern student interacts, receives and responds to learning experiences in new and dynamic ways with an increased emphasis on transferable skills, situated learning (Lave & Wenger, 1991), communities of practice (Wenger & Snyder, 2000), critical thinking and critical reflection. As Nykvist (2008) states, "Students who use them will soon be the majority of students in the classroom" (pp 167-168). The goal for all of us involved in education is to build future practice better than we have used in the past.

A rethinking of educational approaches more broadly and the effective and relevant use of ICT is required particularly at Universities (Cuban, 1993). As Hedberg, Oliver, Harper, et al, (2002) contend new technologies provide rich experiences and can be effectively applied in teaching and learning for the twenty first century. Understanding the nature of these Web 2.0 tools and the possibilities they afford users becomes paramount to the twenty first century communities (Nykvist, 2008) and (Yang, 2006).

The development of Web 2.0 technologies has provided opportunities for users to engage in online discussion and creative design, beyond the walls of lecture theatres and tutorial rooms providing increased collaboration and interaction between individuals and groups. As Lamb & Groom (2010) state, "Without much effort, online teachers and learners can quickly assemble dynamic, networked personal learning environments simply by adopting the most popular tools in any particular domain. Having signed up for a Gmail account, a user can publish websites with Blogger, manage groups and mailing lists with Google Groups, videoconference with Google Talk, write collaboratively with Google Docs, track topics with Google Alerts, manage syndicated feeds with Google Reader, share video with YouTube, post images with Picasa, and do whatever it is that Google Wave is supposed to do. We need not belabor the power and popularity of services such as Flickr, Facebook, and

Twitter. All this incredible functionality is delivered in remarkably stable and user-friendly environments, and it's available free of charge!" (http://www.educause.edu/ero/article/never-mind-edupunks-or-great-web-20-swindle) Web 2.0 users are able to engage, collaborate, interact, innovate, build and reflect on their learning and the learning of others in ways thought unimaginable 20 years ago. As Johnson, et al (2014) affirm, "the use of digital content has become commonplace and the growing awareness of its importance is an important driver of decisions" (p.3). And as such teachers need to have broad understandings associated with the use of Web 2.0 technologies as well as equity, inclusion, and ethical conduct associated with their use in order to build future practices better than we have used in the past.

The important characteristics for twenty first century learning include: critical thinking, problem solving, innovation, collaboration, information, media, a range of technologies, innovative teaching and learning methods supported and enabled by collaborative technologies, as well as key system reforms by governments and other agencies. These characteristics provide strong and relevant connections that prepare learners for a world in which collaboration and change are ever present (Bennett & Maton, 2010, Maloney, 2007; Alexander, 2006; Harris, 2006; Warlick, 2006).

The learning experiences relevant for the twenty first century should be project based, reflect real world complex problems to be solved, be interdisciplinary, and personalized.
"In this interconnected world, with ubiquitous access to powerful technology and access to a worldwide community, new models of teaching and learning are possible" (ACOT, 2011).

The Nature of Web 2.0 Technologies

The term Web 2.0 was coined by Darcy DiNucci in 1999 in her article titled Fragmented Future "The web we know…is only an embryo of the web to come" (p.32). Although the concept of Web 2.0 began with a conference brainstorming session between O'Reilly and MediaLive International (O'Reilly, 2005).

Web 2.0 technologies describe a variety of applications and websites that provide users with the ability to create, share, collaborate and communicate information in an online environment "with greater ease that was previously available" Nykvist (2008, p. 167). The capability of such technologies comes from the fact that users do not require any Information and Communication Technologies (ICT) web design or web publishing skills to participate. Most new forms of Web 2.0 technologies come with mini training modules and thousands of instructional video clips can be found on You Tube making it easy for users to create and publish for a worldwide audience. Although some critics argue that this is the major weakness of Web 2.0 technologies in, "that it is too easy for the average person to affect online content and that, as a result, the credibility, ethics and even legality of web content could suffer" (Rouse, 2014). Regardless of such criticisms Web 2.0 technologies have become the norm for many users in the twenty first century.

Web 2.0 technologies afford pre-service teachers with ICT capacity for inquiry, creativity, research, communication, competition and collaboration to construct new learning and insights that are accurate, authentic and relevant to the twenty first

century learners. Solutions to issues or problems identified are researched, evaluated, redesigned, reflected upon, linked to curricula and targeted at both local and global audiences. Educational content can be delivered via Web 2.0 technologies that provide for multimedia and multimodality to suit a range of learning styles, differing abilities and even alternative formats for students with disabilities. The social interactions among learners play a crucial role in the processes of learning and cognition (Vygotsky, 1978). It is the participatory nature that Web 2.0 technologies afford that Cognitive tools such as Web 2.0 technologies provide a vision of what future learning environments should be like (Kim & Reeves, 2007). When linked to social constructivist learning approaches (i.e. authentic pedagogy) and real world issues learners (i.e. pre-service teachers) are being prepared for the "messiness" of the twenty first century workplace (Lombardi, 2007, p.3).

The Use of Web 2.0 Technologies in Pre-Service Teacher Education

Researchers into ICT use in education, such as Turkle (1984), Papert (1980) and Yelland, Neal and Dakich (2008), as well as Dede (2009) argue that students construct reality from their own lived experiences and prior knowledge. The ICT tools (i.e. websites and Web 2.0 technologies) utilised by students today provide an authentic context for learning through investigating, communicating and creating with ICT (http://www.education.vic.gov.au/school/teachers/support/Pages/planning.aspx). "The context in which digital technology is deployed needs to change if we are going to drive better educational outcomes" (Nesta 2013).

Technology is an ever present reality in the lives of twenty first century students and to be relevant such tools need to be digital. "Outside of the formal educational setting, students have access to high quality games, which incorporate high levels of interactivity and a multitude of pathways and levels of difficulty" (Gregory, S. et al, 2014, p.286).

The use of Web 2.0 technologies provides for active participation by students in their own learning through doing rather than passively listening and reading (Levin & Alexander, 2008), (Collins & Halverson, 2009) and (Gaffer, Singh, & Thomas, 2011). The use of technologies provide opportunities for pre-service teachers to create, play, design, trial, reflect and explore educational ideas associated with curriculum content. The use of ePortfolios, WebBlogs and Wikis, for example, affords opportunities for collaboration, reflection, innovation, creativity, and design in an online format. Knowledge is built, learning is active and assessments (using Rubrics) are easily built into tasks promoting authenticity. Engagement, motivation and challenge are provided through the use of Web 2.0 technologies. Multimedia, interactivity and communication between users reflecting upon their higher educational learning experiences helps to provide a more positive attitude towards their own learning.

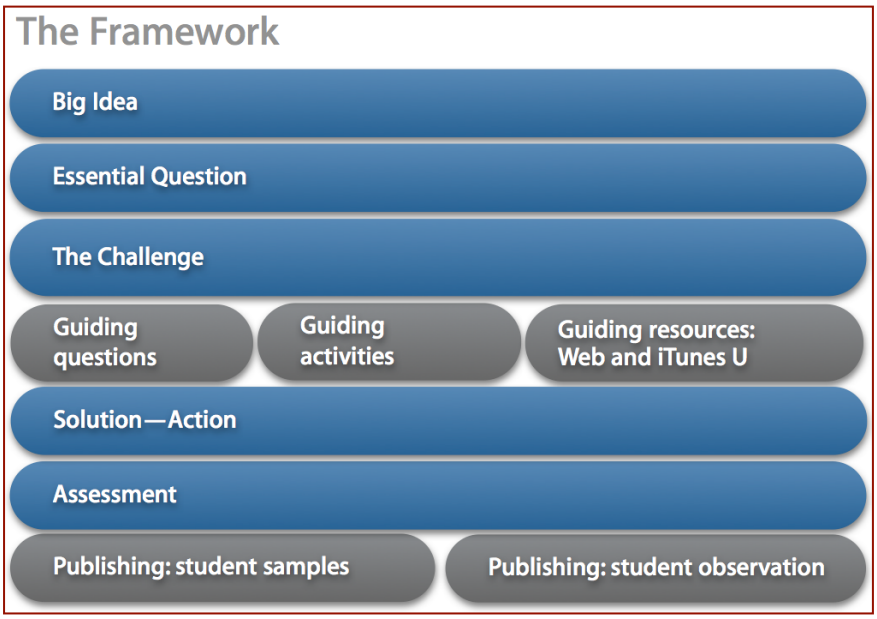
Web 2.0 technologies incorporate the principles of Universal Design for Learning (UDL) providing educators with creative, flexible and innovative pathways that accommodate the learning needs of students. The acquisition of new knowledge is enabled through the use of Web 2.0 technologies providing multiple directions and a flexible means for student voice in the use of text, images, designs, music, and video. The UDL principles of creativity, collaboration, exploration and interactivity are also enhanced (CAST, 2011).

For pre-service teachers the author encourages a multidisciplinary approach across a range of technologies used in their daily lives to solve real world issues.
Collectively this is known as Challenge Based Learning (CBL).
"Challenge based learning is a collaborative learning experience in which teachers and students work together to learn about compelling issues, propose solutions to real problems, and take action. The approach asks students to reflect on their learning and the impact of their actions, and publish their solutions to a worldwide audience" (Johnson & Adams, 2011, p. 4).

Challenge Based Learning and Web 2.0 Technologies

The framework for Challenge Based Learning (CBL) begins with a big idea, followed by an essential question, a challenge, guiding questions, activities, resources, providing solutions through action based on reflection, assessment and finally publishing to a wider audience (ACOT, 2009).

Figure 1: Framework for Challenge Based Learning:



ACOT (2009). p. 2. http://ali.apple.com/cbl/global/files/CBL_Paper.pdf
Web 2.0 technologies provide an extensive range of applications to assist such inquiry with the CBL framework requiring pre-service teachers working collaboratively in small groups, having 24/7 access to technology and mentoring from lecturers. Assessment Rubrics are established to support the investigation and formal assessments can be incorporated into the process. Ongoing research and individual and team reflection into the issue are essential. With the proliferation of Web 2.0 technologies pre-service teachers are provided with multiple means of representation and publishing to a worldwide audience. The issue selected and the inquiry process based on research by the teams are linked to the Australian Curriculum and specifically for Victorian schools, the AusVELS.
"AusVELS is the Foundation to Year 10 curriculum that provides a single, coherent and comprehensive set of prescribed content and common achievement standards,

which schools use to plan student learning programs, assess student progress and report to parents" (VCAA, 2014).

Up until two years ago at La Trobe University (School of Education) such CBL inquiry was referred to as a Webquest. An online example of such a Webquest as an integrated unit of study by Allinson and Egan (2012) based on Refugees can be found online at: http://webquests.wix.com/refugeeswebques#!
Over the last two years the decision was made to change this to iQuest (rather than Webquest) as it resonated better with newer technologies available and reminded the pre-service teachers that the process was one of inquiry.

Over the past twelve years of undergraduate and post-graduate courses (across two Universities) the author used an extensive range of technologies from software packages such as MS Word, MS Publisher, MS PowerPoint, Inspiration, Adobe Photoshop, Photo Story for Windows, Blackboard (Moodle), PebblePad to the use of Web 2.0 technologies and innovative websites such as Blogs, Wikis, Weblogs, Voice Threads, Wix, GoAnimate, Wordle & Tagxedo, Make Believe Comix, DeVolver Movie Maker, Prezi, Vimeo, Storybird, Voki, Zooburst, BuildYourWildSelf, Delicious, ToonDoo, Scootle, ABC Splash, and FUSE.

Most assessment tasks within educational subjects at La Trobe University (School of Education) require reflection, research, inquiry, communication, collaboration, and creation. PebblePad™ is used extensively as an eResource providing a creative eportfolio portal for pre-service teachers in curriculum such as Science, Mathematics, English, Professional Practice, Research, Multimedia and ICT. Allied to this is the university's use of Blackboard Moodle as a Learning Management system. Both systems provide users with a plethora of resources including hyperlinks to online and blended learning modules and have provision for uploading of assignments for sharing among the student population. The CBL inquiries developed by pre-service teachers are ably supported through the use of these forms of Learning Management systems.

Pre-Service Teachers Use of Web 2.0 Technologies at La Trobe University

Across a range of subjects in both undergraduate and post graduate degrees La Trobe University pre-service teachers within the School of Education are exposed to a range of Web 2.0 technologies and provision for assessments using such technologies is inbuilt into subject learning guides. Rubrics are developed to provide assistance to the pre-service teachers as they reflect, build, develop and experiment with Web 2.0 technologies they have selected (Carlson & Jesseman, (2011). The introduction to Web 2.0 technologies has provided new ways of presenting information and ideas in interactive ways unfathomable twenty years ago where essays and written examinations were the main forms of assessment for most university subjects.

Today the pre-service teachers can upload digital content created within collaborative small teams as well as individually to such websites as: Flickr, Vimeo, PebblePad, Moodle, Presi, Go Animate, as well as a range of WIKIs, and Blogs. Students can upload the content from lecture theatres, tutorial rooms, computer laboratories, their own homes, libraries as well as any establishment offering fre Wi-Fi. The sharing of

such digital content can be limited to members of specific online groups, or delivered to a global audience utilising such sites as Google Blogspot, Vimeo and Flickr.

Examples include: a Science experiment videoed as part of EDU4PST subject and uploaded to Vimeo: https://vimeo.com/40807341 as well as a Design Brief application involving materials technologies: https://vimeo.com/40493898 both by pre-service teacher Brendan Wardlaw (2013). Pre-service teachers are presented with a Design Brief and all physical materials they require to solve the problem of 'How to Make a Frog Jump'. As they work in pairs through the Design Brief three step process (Investigate/Design, Produce, Analyse /Evaluate = ID/P/AE) pre-service teachers create solutions to the problem posed. Each pair reports back to the whole workshop cohort and demonstrates their designs. Videos are made of the jumping frog and then uploaded to Vimeo by each student pair (understandings based on this process for Victorian education based upon AusVELS curriculum material can be found at: http://www.vcaa.vic.edu.au/Documents/auscurric/progressionpoints/DCTProgression Points.pdf).

Other examples of Web 2.0 technologies used for inquiry and reflection at La Trobe University (School of Education) by two pre-service teachers Kym Barbary and Lisanne de Jong developed after a three day intensive can be found here: http://reflectionkbarbaryedu4uml.blogspot.com.au/ and http://www.uml-lisannedejong.blogspot.com.au/. These Blogs demonstrate a creative use of Web 2.0 technologies (i.e. Google Blogspot) based upon student reflections including the use of other Web 2.0 technologies, software used in workshops, lectures and workshop content. The power afforded by Web 2.0 technologies and the educational impact realised by pre-service teachers when using such software for a global audience enhances their ICT understandings as well as the notion of online communities of practice. The inquiry, the creation and communication based on the use of Web 2.0 technologies enable collaboration, research practice, independence and the construct of new learning. Pre-service teachers have ownership in the development of creative solutions based on the content studied and are able to apply a range of design processes that combine media elements for a solution suitable to both the requirements of the subjects studied at University and their own personal needs. There is also an element of experimentation and choice in generating such creative ICT solutions. However there are many ethical and moral issues associated with the creation of such online Reflective Blogs (e.g. individual rights, cultural expectations, copyright, and protection of electronic information as well as the impact of such globally assessed ICT materials by others). And it's partly the responsibility of academics at universities to remind as well as inform pre-service teachers of their responsibilities in this regard. The use of Web 2.0 technologies as tools for educational use in the twenty first century enables pre-service teachers to develop new ways of thinking, inform others worldwide through personal reflection and feedback as well as providing creative and innovative pathways for their teaching practices.

Recommendations for Practice

Promoting the goals of excellence and equity has to be at the heart of every Higher Educational Institution enabling students to become successful, confident and creative learners so that they can become active and informed citizens. The goals and

outcomes can be delivered through, "New technology-based models of learning" and a variety of educational tools such as Web 2.0 technologies (Deed, 2013, p. 48). Subsequently, students are provided with a digital voice to choose from a range of Web 2.0 technologies to assist their learning as well as for assessment purposes across a range of disciplines.

But such outcomes can only be achieved when academics provide their students with opportunities for authentic learning incorporating real life experiences utilising the tools of Web 2.0 technologies and the CBL models (discussed above). As, "… without skilled and effective staff conducting teaching in new ways, student learning is less likely to be as successful as it might be" (Jeffrey et al, 2012). Academics must see themselves as co-learners in the educational process through learning by doing. They need to create real world educational learning environments that merge both formal and non-formal learning to foster creativity, curiosity, and experimentation in twenty first century students. New forms of assessments based upon the use of Web 2.0 technologies can be captured through rubrics that incorporate collaboration, inter-disciplinary learning, student peer assessments as well as self-assessments, and the quality of learning that achieve professional teacher standards. As Tsai (2009) states, "conceptions of web-based learning were often more sophisticated than those of learning in general" (sec. 4, para. 2).

However such recommendations can only be fostered through the provision of professional learning for academics in the use of digital technologies by Higher Educational institutions across a range of disciplines and literacies. Opportunities for academics to familiarise themselves as well as practise using such Web 2.0 technologies is important. For as familiarity with using such technologies increases, the attention to learning and engagement, with pre-service teachers comes to the forefront. As Hattie (2008) affirms, teachers are the "most powerful influences in learning" (p. 238).

Conclusion

The use and significance of Web 2.0 technologies in education for pre-service teachers lies with the affordances they provide (i.e. networking, collaboration, communities of practice, editing, writing, reflecting, and the sharing of knowledge, ideas and opinions). It is incumbent upon academics to be aware of such affordances to support effective teaching and learning within Universities and Higher Educational Institutions. More importantly the use of Web 2.0 technologies must be based on sound pedagogy that is aligned to the course and subject learning objectives, instructional strategies and assessment methods used. In this presentation, I have provided a background to Web 2.0 technologies, discussed the limitations that exist in their use, as well as the practical implications and recommendations for practice of their use by education pre-service teachers through the online examples shown above. The author has also pointed out the importance of professional learning opportunities for academics in using Web 2.0 technologies to familiarise themselves with these tools so that students entering our Universities and Higher Educational Institutions can be engaged in the learning experiences. To strengthen and enhance teacher education experiences Web 2.0 technologies provide new and powerful learning opportunities for pre-service teachers that are authentic and challenging for the twenty first century.

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