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Learning and Knowledge Building with Web 2.0 Technologies: Implications for Teacher Education

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Abstract

Findings from research studies carried out during 2001-2007 at the University of Portsmouth, UK , with online MSc students using Knowledge Forum ®(KF) software provided impressive evidence of the formation of knowledge building communities (KBC's). Since 2005, as part of studies on the Internet with Web 2.0 environments, research has been carried out with undergraduates using the educational blogging and social networking environment Elgg® , to investigate its potential for learning. Findings from student groups over the two years, 2007-2009, using data from postings, focus groups and interviews, demonstrated that there was also tentative evidence of the formation of a KBC in Elgg®. Interim results from two other investigations, a study carried out in 2008-2009 at the University of Cardiff using the micro-blogging environment Twitter for community formation and learning by professional journalism students, and a recent staff survey at the University of Portsmouth into the personal and professional use of Web 2.0 by lecturers, offer key insights into how such technologies offer a new route to learner collaboration and the possible impact on teaching staff. This paper seeks to draw together findings from all these studies to discuss the implications for the development of educational practices in Higher Education towards a student experience which is rich in authenticity and can lead to knowledge creation and innovation. It will deal explicitly with student demands and expectations, the growing participation culture, aspects of privacy and control in social networking, and the changing role of teachers and lectures, and make recommendations for teacher training and preparing University teachers for cultural change.

Background

During the period 2002-2007, groups of distance learning post-graduate students in the School of Computing, at the University of Portsmouth, were encouraged to work in the software environment, Knowledge Forum, creating and maintaining online knowledge-building communities, based on the Knowledge Building Community Model (Bereiter,2002). Under-pinned by an idea-centred curriculum (Scardamalia ,1999), the students devised their own research questions on topics related to *Interface and Cognition Studies*, choose their own activities to further that research, and the rich dialogue resulted in clearly emergent outcomes. As reported in Duke-Williams and King (2008), although successful and there was evidence to demonstrate many of the twelve determinants of knowledge building (Scardamalia, 2002), the exception were those determinants that needed not just online access, but fully networked access to the Internet. With increasing interest in Web 2.0, from 2005, some teaching moved into the online collaborative environment Elgg®. This has a wide range of features including personal and group blogs, file uploads, community message walls, RSS, and extensive tagging of all postings to support emergent themes. Students can create their own communities, and there are many layers of privacy applying to all created artefacts from blog postings to media objects like video and audio clips. Analysis of the postings and results from students focus groups and interviews in 2008 and 2009 showed high levels of student discussion and collaboration; links to authoritative external web sites; 'referencing' in the form of linkbacks both within blogs, and within different community blogs; student creation of their own communities for two other taught units, and membership management of those communities; crosslinking of postings between different diverse communities; and creation of a social network, (Duke-Williams and King, 2008). Although at the time examining the data for evidence of the stages of connectivism (Siemens, 2006), when the Elgg® communities with their cross linked postings were expressed diagrammatically, (See Figure 1), and the results analysed further, clear evidence emerged of the existence of a knowledge building community (KBC) demonstrating all the determinants of knowledge building.

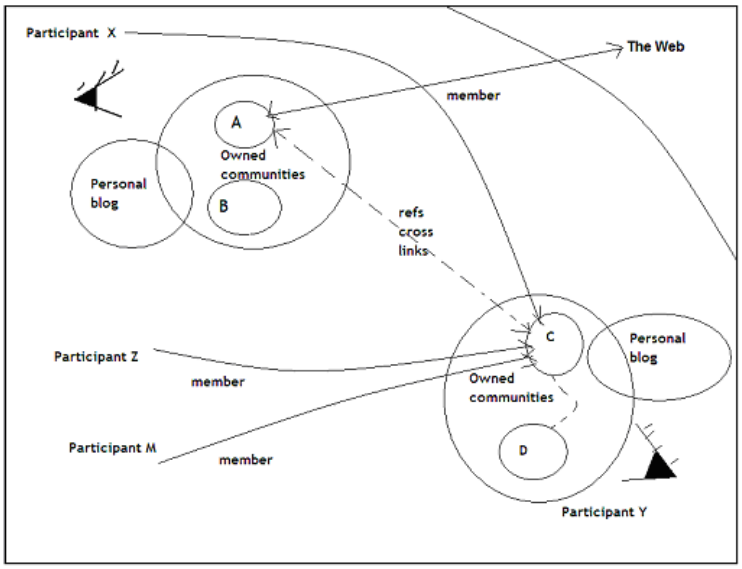

Figure 1 : Representation of KBC's in Elgg®

Although epistemic agency was only weakly observed and students were not able to explicate their thinking using the 'scaffolds' or 'thinking types' available in Knowledge Forum, some student postings revealed that some students versed in critical thinking skills were suggestions theorising and presenting evidence (Duke-Williams and King, 2008). Evidence from student work in Elgg® demonstrated that student dialogue using Web 2.0 tools could be employed for 'knowledge creation' and innovation.

Web 2.0 and Employability Skills

There is a tendency to regard all young people, the so-called 'Millenialls', as a generation that is not only use new digital technologies freely especially for social networking and communications, but also has high expectations of how they should learn using that technology (McLoughlin and Lee, 2008). However the picture is not that clear. Siemens and Tittenberger (2009,28) conclude that existing research does not support the notion that learners preferences are generational where technology is concerned. A UK report from an independent committee of influential tertiary and higher education funding bodies, "Higher Education in a Web 2.0 World (Hughes, 2009),", reveals that while the use of Web 2.0 technologies is "high and pervasive across all age groups from 11 to 15 upwards", that, "the bridge between Web 2.0 in social use and in learning is as yet only dimly perceived by students" (Hughes, 2009, p 6-8). They quote a study on learner expectations as they approach entry to HE and note that, "present day students are not pressing for change in traditional approaches", (Hughes, 2009, p24). These two opposing views on student expectations are however reconciled in notions of the skills set for employability. Hughes (2009) lists five skills – communication, collaboration, creativity , leadership, and technology proficiency – as the skills set that matches views on both 21st century learning and employability skills. Jenkins (2005) had already found that over half of teenagers in the USA had created media content and, in many cases offered it for sharing on the Internet, considered the emergence of the *participatory culture*, which can express itself as affiliations to formal or informal online communities, producing new creative forms (including many media types), collaborating in teams to complete tasks and developing new knowledge, and shaping the flow of media (such as using podcasting or blogging). Jenkins suggests that the new skills set required for the participatory culture is something which the education system should be addressing as the outcome will be students better prepared for future work and an enterprise environment, as these skills are those needed for future employability in the 21st Century. Some of the specific key skills he suggests such as networking, negotiation, collective intelligence, distributed cognition, and appropriation, are evident in the style of interaction noticeable in knowledge building communities and given an affordance by Web 2.0. Conole and Creator (2006) describe students who can select the technologies that best meet their needs, "with a sophisticated understanding of how to manipulate these to their advantage". We can conclude that students and young people are already moving in a new media and communications paradigm, currently building a skills set appropriate for their social and entertainment needs, but as they gain more experience in school learning using Web 2.0 that their expectations for HE will rise markedly and swiftly.

The nature of learning in Web 2.0

What are the features of learning in a web 2.0 environment? Social networked learning or 'social learning' is a handy term for all the learning which is facilitated by social networking software and Web 2.0 tools. Learning has traditionally been linked to an expertise paradigm typified by a reliance on credentials, transmission of knowledge from the novice to the expert, deference, and an association with control through structure. Social learning promotes a very different paradigm with the defining leitmotif of *contribution;* strictly *contribution from the many*. Learning through Web 2.0 is more task-oriented, democratic, reciprocal, voluntary, and dynamic. Flattening of the hierarchies of expertise is very noticeable. Web 2.0 learning communities operate through the concept of *collective intelligence*, and draw on the diverse knowledge and combined expertise of members.

Social learning is best explained with reference to:

Knowledge-creation metaphor for learning. Paavola and Hakkarainen (2005) make a case for a new epistemological basis for learning. Moving from the acquisition metaphor - relying on the idea that knowledge is the property of an

individual mind and, " *pre-supposes given structures of knowledge that an individual learner is guided to assimilate or construct*"; to the participation metaphor, where the focus is on activities and knowledge as the result of participation in community practices, but without any emphasis on transformation of that knowledge; to a new knowledge-creation metaphor for learning where emphasis is on knowledge created and developed and there is transformation. Finding expression in education in the idea-centred curriculum which is typified by students generating their own ideas for research investigations and then planning what activities to pursue, and working together as a knowledge-building community, outcomes as emergent, and never final. Knowledge building communities place an emphasis on ideas diversity; real improvable ideas; authentic problems; the democratising of knowledge; and community knowledge and collective responsibility. The aim of knowledge building is innovation through emergent ideas and there is a recognition that in their interactions, such communities must engage in a discourse with research community qualities, use authoritative sources constructively, and extend their boundaries beyond the immediate participants into a wider community. Web 2.0 has the power to underpin and promote this mode of learning. Student learning though Web 2.0 (using blogs and micro-blogging, wikis, discussion boards, messenger tools) through situated and mobile devices, with students contributing their own digital media artefacts (like images, video, presentations, and podcasts) and networking through many forms of sharing, encompasses the notion of the student as researcher implicitly. To extend the use of Web 2.0 in learning is to automatically involve students in more research. And the ability of knowledge building communities to reach the boundaries of research areas quickly makes research-lead teaching much more possible.

Light and Agile Software. The many types, features, and advantages of Web 2.0 software tools as affordances for learning have been extensively covered by Hughes (2009), Siemens and Tittenberger (2009, p14), McLoughin and Lee (2008), and Alexander (2008). For example, blogging can be used for personal journals, portfolios, and feedback can be given through comments; micro-blogging (like Twitter) for peer-review, ideas, comments and feedback; wikis for group resource construction; and various digital media can be uploaded and shared with lecturers and peers. Even *Facebook*, which is normally used for social contact, can be used for self-promotion and making students feel connected. University wireless networks provide a basis for social learning networks which can be campus-wide, and there no longer needs to be an artificial divide between practice and technology. Web 2.0 tools will no doubt continue to develop and fill even more niches for educationalists to exploit.

Current Staff use of Web 2.0 in Higher Education

Hughes (2009, p37) advises institutions of HE to, "establish widespread awareness and facility of Web 2.0 approaches and applications" and makes ten recommendations for the improvement of staff skills in teaching in this very different environment. To ascertain the position regarding University staff skills in using Web 2.0 , King and Duke-Williams (2009) carried out a survey of 847 lecturers at the University of Portsmouth asking them what Web 2.0 tools they used personally and with students. 183 replied and of those 180 (21%) were using Web 2.0 in some way. It is believed that this was a self-selected sample of those staff already familiar with Web 2.0, and in that respect applying Roger's Diffusion of Innovations Model (1995) the adoption curve shown in Figure 2, indicates that staff at the University who use Web 2.0 are largely still amongst the *innovators* and *early adopters*.

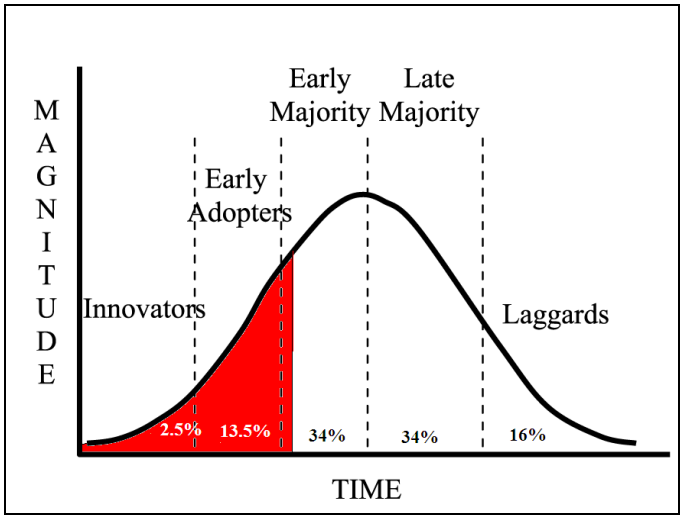

Figure 2: Adoption Innovation Curve for Staff using Web 2.0

Further analysis of the returns showed that the where Web 2.0 software had been in existence for some time (like webmail, online video or images) then these were accessed extensively (by over 80% of respondents) whereas new software like Twitter had very little take-up (7%). Making and sharing web artefacts like video and audio however was the preserve of a much lower proportion of staff, typically less than 20% of respondents with only 1% actually making podcasts. Those who chose to use Web 2.0 tools with students was approximately one-third of those who used any one tool. For example 38% of respondents used wikis, but only 14% used those with students. There were no instances of a tool being used with students without it being first used by a staff member for personal or professional reasons and this is considered to be a key

finding. Figure 3 shows the relative proportions of staff who use Web 2.0 features passively (viewing or reading), those who use Web 2.0 actively (building or making), either personally or with students, and those that encourage students to use Web 2.0actively themselves.

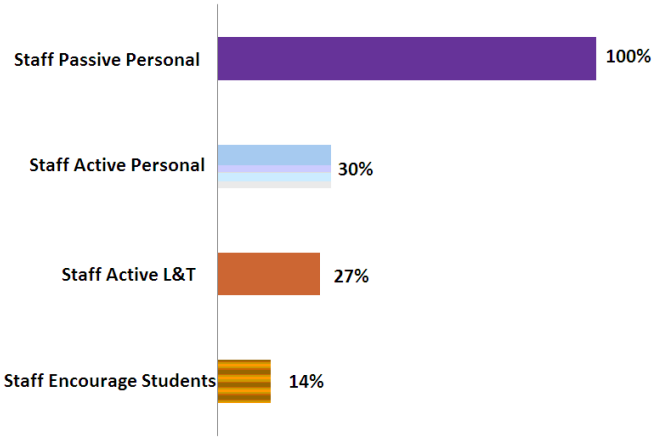

Figure 3: Relative proportion of staff using Web 2.0 passively or actively

As the percentage of staff actively using Web 2.0 (30%) is very close to the percentage of those using it actively with students (27%), it is possible that the major active use of Web 2.0 for staff is closely connected with their teaching.

Some of these results are complemented by the MASIE Centre (2009) Social Learning Survey which was sent to Learning TRENDS Readers - Global Learning Professionals - and had 1069 responses. Particularly, in response to the question, "Do you currently have a social learning project?". Although 80% of the respondents had used social networking personally for over one year, the results, 65% -No and 35% - Yes, showed again that the proportion of respondents who actively engage with students or trainees using social learning is about one-third.

The conclusion that we can draw from these figures is that any expertise in Web 2.0 is restricted to innovators and early adopters, while active participation in Web 2.0 or using it with students, is being carried out by a very small proportion of innovators. And finally, staff must be active in Web 2.0 themselves in order to use it in their teaching practice. Although a somewhat dismal picture, this does give some pointers for future training of teachers in HE.

A further indication of how staff might become actively involved with students in Web 2.0 and enable students to carry out their own work in these environments was demonstrated by Mottershead (2009). Using Twitter as a professional journalist, he encouraged his students to first 'follow him' in Twitter and then as they gained confidence they were able to branch out and choose other professionals to follow, and finally by use of relevant and effective tweets to gain followers themselves. This use of modelling behaviour by the lecturer seems closely linked to a type of apprenticeship learning, and should be carefully considered as a technique by pre-service teacher trainers who have some fluency with Web 2.0 themselves.

Implications for the professional development of teachers

The experiential nature of learning about Web 2.0

Working in Web 2.0 for most teachers requires a 'paradigm shift' in their thinking and practice. Most have been educated themselves in more traditional systems that are not participatory, where they feel comfortable with the notion of expertise, and using that expertise to structure and deliver content to novices. This will be true even for teachers and lecturers who employ more constructivist or 'problem-based' methods. One noticeable difference is the relative informality of Web 2.0 communications (Hughes, 2009, 22) and the playful nature of interactions that can make Web 2.0 seen trivial. For staff, learning how to operate in Web 2.0 is experiential. They will have to experience it to be able to fully understand the medium and work within it. Having lectures or talks or workshops on the subject of Web 2.0 where you are told about Web 2.0 is of limited use. To train teachers in Web 2.0 they will need to find some part of this new environment that interests them and actually experiment themselves.

Barriers to adoption of Web 2.0

One of the main barriers to adoption of Web 2.0 tools are staff fears beyond those normally associated with the introduction of online learning in an institutional LMS type installation (such as Blackboard or Moodle), such as poor ICT skills, increased work-load or loss of face-to-face contact with students. Hughes (2009) offers these as main fears about Web 2.0 in teaching:

- The high level of access to and engagement with technology, and the implications of the 'always-on'

classroom for workload management and encroachment on their personal , scholastic or research time. Apart from teaching, academic staff have a wide range of responsibilities that make demands in their time and they actively resist spending more time on teaching matters such as becoming familiar with new pedagogies or spending more time online with students.

- Lack of systematic deployment of Web 2.0 by institutions so technical support is poor or non-existent. Innovators in using Web 2.0 for teaching often use 'unofficial software' which they support themselves and risk losing their own work and that of students. This experimental approach has resulted in a wide range of Web 2.0 tools being deployed in teaching, often simultaneously with the same student group. Duke-Williams and King (2009) in the Web 2.0 survey found 90 members of staff using over 30 different software tools with students. This fragmentation of the learning landscape not only seems overwhelming by uncontrollable.
- A recognition that implementation of Web 2.0 will require a 're-negotiation of the relationship between tutor and student ...[which] may involve drawing students into development of approaches to teaching and learning'; even to asking students to help with software or materials development. To some staff this would involve a considerable loss of personal esteem.

Siemens and Tittenberg (2009, 15) offer this list of requirements for teaching successfully with emerging technologies:

- A spirit of experimentation.
- A willingness to engage learners in the co-creation of content.
- A willingness to 'let go' of control and content presentation approaches to teaching.
- Tolerance of failure.

Anecdotally, some older staff are unused to the degree of exposure that younger people are prepared to accept on the Internet and fear a loss of identity, loss of privacy, social exposure and even identity theft. Any initiatives to get staff to use Web 2.0 more freely will have to focus on building trust.

Reflection on Control in the Teaching Environment

Traditionally teachers do not reflect much on control in the classroom or lecture theatre, beyond the need to 'keep control' instilled during training. However the fear of losing control soon surfaces when online teaching with Web 2.0 is considered. Dron (2007) considers both 'transactional distance' and 'transactional control' in learning interactions. Transactional distance is the psychological gap that can exist between tutor and student depending on the degree of structure in a course, whereas transactional control considers the choices that are made by teachers and learners in the teaching environment. Figure 4 shows how the level of control can vary.

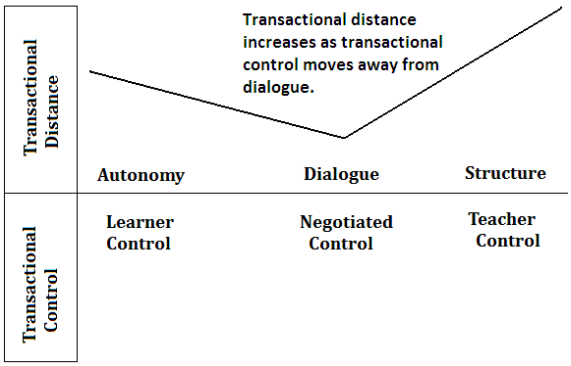

Figure 4: Transactional control mapped to transactional distance (Dron, 2007)

When the teacher chooses to take control then they produce structured materials and/or learning interactions and the transactional distance between themselves and their students is greatest. This the zone in which most teachers operate, except when they choose to allow students to take control of their own learning or a degree of autonomy, when control passes to the learner, but this does not decrease (much) the extent of the transactional distance. The participative web or Web 2.0 demands more negotiated control or true dialogue between student and teacher in determining the choices that are being made in the learning interactions. While this is best from a learning perspective, offering learner-centric education while at the same time allowing teachers to intervene as mentors or experts as

appropriate, transactional distance is lowest, and this is a position where possibly teachers feel uncomfortable, as it needs better teaching skills and more time devoted to engagement with students. Apart from the usefulness of this model in helping teachers alter their perspective on loss of control, Dron (2006) takes this further by suggesting that social networking software (like Elgg®) which presents options, links, paths, crosslinks, trackbacks and a wide range of interactions, leads to an emergent structure, providing control over the learning trajectory "fulfilling the teacher's role". Duke-Williams and King (2008) suggest that for this reason 'social networking software' should be renamed 'social learning software' to emphasise its potentially powerful role for education.

Differences between Web 2.0 software and institutional VLE software

Staff embarking on teaching in Web 2.0 may have had experience of blended or distance learning using an institutional VLE like WebCT, Blackboard or Moodle. It may instructive to appreciate that there some critical differences between those two, when actually engaged in teaching. Dron (2007) raises these:

- **Parcellation and Scalability**. Innovative or emergent outcomes will be more likely to arise from student groups working online distinct 'niches' or communities, which evolve naturally during the course of discussions or research, and which are weakly connected to other groups. The development of such community niches can be promoted by the use of 'tagging' – a feature which is made available extensively in Web 2.0 software. The recent use of Twitter to form a community around the political unrest in Iran using tags such as *#iran_election* has demonstrated the power of parcellation, as does using tags to provide backchat during professional conferences. Dron (2007) suggests that top-down use of such parcellating features like tagging helps tutors retain control, while bottom-up student generated methods offers students a degree of autonomy. Also, unlike a VLE where more participants especially in discussions or chat sessions will cause problems and require extra session to be created, social networking software is easily scalable. Many small scale interactions will inevitably arise, in a dynamic and fluid way, and students will expect to engage simultaneously in several groups or communities, and staff need to gain a sense of how to maximise the potential of such an environment for themselves.

- **Constraint.** The structures available to staff using a VLE are rigid and pre-defined. The provision of structure using Web 2.0 tools is under the control of the lecturer or teacher, and they will need to exercise that control sometimes, and build in constraints. Experimentation with tools to appreciate how this may be accomplished will be time consuming.

One of the issues for students and staff is the requirement to use both an institutional VLE and Web 2.0 tools simultaneously. Students complain that they 'have too many places to visit'. Dron (2007) calls this the 'two-headed monster'. One suggestion for avoiding too much movement between software packages is to reserve the VLE for published content. This may be created by the lecturer , such as assignments or course manuals, but the VLE may also be a place to record material that students want published, such as research results, key decisions, findings, URL's. The discourse continues within Web 2.0 but all participants know where to find the essential finalised , published materials. Alternatively wiki software can be used to build content in this way, with the VLE virtually abandoned apart from institutional requirements. Whatever the method is employed staff need to be aware that there may be a problem to manage.

Recommendation for Teacher Training on Web 2.0

Teacher training for working in Web 2.0 with students will require an activity-based, hands-on approach comprising careful preparation for staff with weak IT skills and a set of graduated activities. The following plan is suggested:

- **Level 1. Using Transparency**. Create a profile in a social networking environment. A simple step for which staff are encouraged and supported to exploit all the privacy and security features of the software. Dalsgaard (2008) suggests that this the basis for and starting point for social networking: the individual, the personal. That unlike discussion groups where in order to be present, you must make on entry, in social networking, you are 'always' present. Other ICT skills can be invoked here if staff are confident, such as creating and uploading a photograph. There is no requirement at this level for staff to engage with the community at large, it is enough to feel comfortable just being present.

- **Level 2. Reaching out**. Searching profiles to find other like-minded community members or people who might be useful to them personally or professionally. When they feel confident, further small activities can be introduced to enable them to engage with the others postings. If Twitter used as the social software then the trainees can start to search for people to follow, and just observe their tweets. Later they can make postings themselves. Using Twitter tags will enable them to follow and take part in a low-risk, transient community, such as one that might form around a professional conference. As part of this stage, trainees are encouraged to start a private online learning Journal. If community software like Ning is being used, then a personal blog is provided for each user.

- **Level 3. Exchanging Information**. Activities are introduced using Web 2.0 tools which not only widen the trainee experience of Web 2.0 but offer them an affordance for various professional activities in which they are interested and which should be built into the training course itself. Craig (2007) reports on a Learning 2.0 initiative where library staff must complete the "23 Things" programme with a series of Web 2.0 related including occasional 'Stretch Tasks' for familiarisation and extending their facility with Web 2.0. Trainees should be encouraged to use bookmarking software like Delicious, or to experiment with environments like Diigo, which could be used a s the basis for work on the course itself. Diigo allows you to communicate with others through content, by finding and annotating web pages, these can be used as the basis of group projects. At this stage, the group of trainees should be offered assignments where they need to work together on shared artefacts. McLoughlin and Lee (2008) have summarised fourteen examples of learner tasks with matching Web 2.0 technologies which could be used as suggestions for tasks in this section.

- **Level 4. Construction**. Another most important part of Web 2.0 working for staff and students is the use of Wikis for producing shared online content. Part of the work should now incorporate the group collaborating on a simple wiki – perhaps to produce a shared report. A significant part of the Web 2.0 culture is creating digital artefacts (like web pages, images, video clips and podcasts), and sharing them on the Web. At this stage, activities should be introduced and technical support provided so that trainees can try some of these activities as well as becoming familiar with simple tools such as Flickr, YouTube, and SlideShare.

- **Level 5. Knowledge Building**. The trainees are required to work as a research community on the Internet, working on their own research idea, carrying out appropriate activity and producing a publishable outcome. At this stage students should be familiar enough with a range of Web 2.0 tools and the various nuances and advantages of these to be able to plan and negotiate the tools that they will use to do this, sharing research findings and any artefacts created.

The time require to accomplish each stage will vary with the trainees previous knowledge and skills, but it must be expected that there will be certain reluctance amongst busy staff to get involved and to cover all stages will take many weeks. For that reason we suggest sub-diving the stages into four successive courses, with Stages 1 and 2 covered in one introductory course, all sections to be completed over about 6-9 months. In this way, the training could form one module or unit in a formal Certificate of Education qualification.

Conclusion

Research has shown that a Web 2.0 environment like Elgg® can support a wide range of learning activities, including collaboration to form a knowledge building community. However although influential reports strongly recommend that educational institutions urgently engage with Web 2.0 to provide students with a 21st century employability skills, teaching staff who do use Web 2.0 are at best *early adopters*, and active use with students is the preserve of the *innovator*. There is resistance from teaching staff to getting involved with Web 2.0 because of the little place it plays in their lives, personal or professional, and their poor perceptions of social networking. There is a extraordinary paradigm shift required to move into teaching reflecting a knowledge-creation metaphor, rather than the acquisition metaphor with which many lecturers are familiar. There are also fears of additional work load, using software not supported by their institutions, and loss of control in what to most will be a novel teaching environment where co-teaching and negotiation with students will be common place, if not essential, very unlike even the institutional VLE,. If training of teachers is to be successful, it must follow a graduated plan of activities using Web 2.0 software, designed to overcome fears, build confidence, and familiarise staff with the many useful tools and applications within the context of their own learning.

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