Web 2.0 Technologies: A knowledge gatekeeper perspective in the educational environment

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Abstract

The literature on Web 2.0 technologies addresses many aspects of the subject; however, one issue that needs attention is that of how knowledge gatekeepers interact with e-learning communities. Action research was used to study a course in knowledge management over several years, with each presentation of the course an iteration of the action research cycle. Through evaluating learning outcomes and student feedback, the conclusion is reached that the introduction of Web 2.0 technologies has changed the role of the traditional knowledge gatekeeper (the teacher) from a deliverer of knowledge to a facilitator or knowledge guide. In addition, this role change enables students to take a more active attitude towards their learning. This paper considers this issue from the perspective of the knowledge gatekeeper, and technology support of that interaction.

Key words: Web 2.0, knowledge gatekeepers, action research, teaching and learning, pedagogy, constructivism

Introduction

Web 2.0 developed out of the dot-com crash in 2001 following the rationalisation of companies and technology, when new generations of the surviving software came into being (O'Reilly, 2005). Alexander (2006) claims that Web 2.0 is an extension of Web 1.0 capability and that there is no "single new development." According to Downes (2005), what was happening was that the Web as we knew it in the late 1990s was transforming and taking on the properties of a communication network, similar to those found in the real world, and that Web 2.0 is not a technological revolution but a social one. New or enhanced technologies in Web 2.0 promote social networking amongst peers and in a learning environment. A social learning atmosphere can engage students with peers to share information and discuss concepts pertaining to the course they are undertaking. When groups form, a group-member will normally take a leadership role and, if this group member is the knowledge holder, this person may become the knowledge gatekeeper within the group, therefore effectively deciding who has access to what knowledge. In a learning environment, the teacher/facilitator is also a knowledge gatekeeper, as the teaching role is traditionally someone who enables student access to information and disseminates it to the class.

Changing technologies lead to changing methods of delivering educational programs and changes the form of the delivery from the more traditional teaching methods of sage-on-stage or stand and deliver, sit and receive to a technology-facilitated setting where students can design their own learning environment to some extent. This can assist in creating a more interesting learning environment for the student than the traditional classroom, as he or she reconceptualises learning and takes responsibility for the accumulation of his or her own knowledge. Social networking software such as blogs, chat rooms, and discussion boards make communication easier between peers and the learning facilitator.

While acknowledging that some form of knowledge management is necessary (by the knowledge gatekeepers), the role has the potential to become one of control, in that essential knowledge may be withheld from other members of the group. The purpose of this paper is to provide practitioners with an example of how e-learning environments can counter the effects of these parsimonious knowledge gatekeepers, with additional perspectives on the core issues of knowledge gatekeeping in a Web 2.0 world. As a detailed illustration, details are presented of the use of blogs throughout the course, firstly to elicit students' opinions and understanding of topics, and then to use these contributions as the basis for class discussion following organising and expansion by the teacher/facilitator. Each student was required to locate (or produce) an image related to the set topic and explain their interpretation of that image; they were also to comment on each other's images.

This paper is organised as follows, a presentation of literature relating to Web 2.0 technology from the perspective of knowledge gatekeepers and learning approaches. This is followed by a description of the research methodology and the study. A discussion is presented in terms of student learning outcomes, the roles of knowledge gatekeepers, and the importance of Web 2.0 technology following a summary of the results of the study and further research directions are indicated.

Background

Our definition of a knowledge gatekeeper is somebody who facilitates access to information and disseminates it to a group or the wider community. This person may or may not be a subject expert, but is someone who others view as having a role in disseminating that information. According to Stephenson (1998), gatekeepers are located at the critical pathways within networks and link other networks together by acting as a bridge. To extend the definition of a knowledge gatekeeper in the context of this paper, a knowledge gatekeeper addresses information within a specific area of knowledge and acts as an information/knowledge bridge between diverse groups or individuals. These groups or individuals can be at the same location (a classroom) or be accessing the learning materials via the Internet whilst located anywhere in the world.
Figure 1 shows our understanding of how the knowledge gatekeeper acts as an information bridge between various groups. The purpose of a knowledge gatekeeper is to facilitate communication between the groups and/or individuals, whether the environment is learning or organisational. Because of the position of the knowledge gatekeeper in the social network, the gatekeeper has influence not only on the content that flows between the groups but also on the perception of the value of the information.

Figure 1 Knowledge gatekeeper as bridge
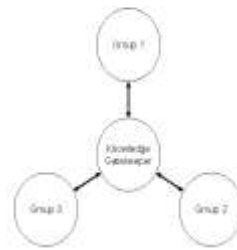
Cranefield and Yoong (2007) suggest that the most important role of a gatekeeper is that of translator and interpreter. Communication is central to the concept of a gatekeeper and Harada (2003) claims that a lack of common understanding will impede communication and create misunderstanding of the message transmitted. This is consistent with our definition offered above and provides a useful platform to move the knowledge gatekeeper into an educational environment. Harada also suggests that gatekeepers are the translators of information external to the group or groups, and in an educational context. This is also consistent with the concept of the teacher as knowledge gatekeeper, interpreting the course material and communicating it in terms that the students understand. With the advent of increased communication offered by the Internet (and Web 2.0 technology) the position of the knowledge gatekeeper has the potential to expand the communication into a global community of influence.

Characterising what makes Web 2.0 different from Web 1.0 is not easy; there are many examples given, but few, if any, definitions. In the context of e-learning, services such as blogs and wikis come readily to mind; as do less obvious changes such as the adoption of AJAX technology (present in applications such as Google Earth). What is apparent is that a variety of new ways is readily available for teachers to interact with students when compared to traditional face-to-face classroom teaching.

Current learning management systems (Allen, 2005) support collaborative learning, meaningful tasks, communication, and a sense of belonging to a learning community. Thus, one of the advantages of an online teaching and learning environment is the possibility of building on the collective wisdom of the participants, thereby overcoming some of the problems of lone learners (Gan & Zhu, 2007). One effect of online teaching and learning is to highlight student behaviour in terms of their working in teams. By moving to a collaborative model of interaction (where a high degree of concurrent interaction is necessary), possibly enforced by the online environment, the skills associated with the sharing and co-development of knowledge may be enhanced.

While the use of online environments is seen in some quarters as a cost-saving measure, and hence not sustainable from an educational perspective, feedback from students suggests that online discussion forums provide a genuine learning experience, especially by enabling greater freedom of speech. A factor that may enable this feeling of disinhibition is the perceived anonymity afforded by online

discussions and the ability to engage others without the fear of ensuing consequences (Christopherson, 2007). However, perhaps the most significant change engendered by Web 2.0 is the change from a Cartesian view of education (transmission) to so-called social learning. In the social learning view, the emphasis is on using how people learn (process), to support what they learn (product). By using Web 2.0 technologies, social learning can develop and satisfy the needs of a digital society (Brown & Adler, 2008). As noted in a later section of this paper, the students responded to the use of Web technologies in the knowledge management course because the course used the tools that digital natives were expecting to use: the learning tools of their generation (Prensky, 2004a).

Web 2.0 technologies support student social learning in that the learning environment can be online, using interactive tools. For example, the learning management system Blackboard contains a virtual classroom where students can collaborate to find solutions posed by the teacher. For many students, these aspects of online technologies are familiar in their social interactions, so the students are able to utilise them effectively in an educational setting. Saab, van Joolingen, and van Hout-Wolters (2005) suggest "students lack skills and insight on how to discuss their knowledge with their co-workers" and that something familiar to all involved may be needed to encourage an exchange of arguments. They further suggest that a concrete trigger such as a question may get the knowledge exchange started. In the example of the virtual classroom, the knowledge gatekeeper acts as both the bridge and the trigger by asking the students questions pertinent to the course material.

The method(s) of communication between the participants in the teaching and learning setting is also impacted by the Web 2.0 technology, in that it opens up different ways of exploring the concepts that constitute the material under consideration. Differences in language abilities (reflected both in verbal discussions and written work) have been recognised as being a barrier to effectively communicating ideas, opinions and understandings, and images have been used as a medium that allows the expression of a view of reality without words (at least initially) (Clover, 2006; Miles & Kaplan, 2005). Online learning interaction for digital natives is as real to them as is attending a physical classroom and meeting their peers face-to-face (Prensky, 2004b), and by supporting multi-media, Web 2.0 technologies present the opportunity to explore the use of images in knowledge transfer, and to consider the change this may have on the role of knowledge gatekeepers.

With the changes in the teaching and learning environment that come from the adoption of Web 2.0 technologies, and the consequent effect on the role of knowledge gatekeepers, it is timely to reflect on the impact these changes may have on the roles of both students and teachers. Of these changes, perhaps none is more important than the roles of learner and educator. Traditionally, students acquired knowledge from their professors; this is the objectivist view of education. Current thinking on education favours the constructivist approach, where teachers become facilitators or guides. This change from an objectivist to a constructivist paradigm is a challenge to many educators, yet the benefits and possibilities of this alternative approach are persuasive (Arbaugh, 2002)

One of the more obvious changes will be the purpose of the interaction between learners and teachers. In a traditional teaching and learning environment, support from teachers was concerned with the substantive content for the learner, whereas in a Web 2.0 environment, the support is more psychological in character. Moving to an online environment will change the type of support offered by a teacher,

particularly when supporting the motivation of students who may be alone and unused to sharing their thoughts in an online medium (Ham & Davey, 2005). Students may not be motivated to participate and subsequently may feel alienated and therefore further de-motivated to participate (Suler, 2004). This brings up the challenge of how the communication will take place, for communicating in the online world is quite different from face-to-face or written interactions. Face-to-face judgements of peers are not necessarily a factor in online communication and the power to influence is assessed by the quality of the interaction and information transferred to others in the group. Online communication does not require the participants to allocate cognitive resources to understanding nonverbal communication codes (Walther, 2007); therefore, a participant can spend more time composing their response to concepts posed by facilitators or guides. Consequently, not only do the transmission roles change, but also the way communication occurs. The ubiquity of emails, voice mail and texting means that the preservation of the content of the message has to survive the medium (Reinsch & Turner, 2007).

While there is likely to be significant changes in the relative roles of teachers vis-à-vis students, there is also likely to be a change in student-to-student relationships related to learning strategies. For example, reflecting on practice is seen as a valuable part of the learning experience, developing in students an ability to be critical in selecting the information relevant to a particular situation (Schwartz, 1996). Online facilities such as discussion forums and blogs provide an opportunity for students to develop their writing skills and receive feedback; studies have shown that students can use the medium effectively to develop their reflective skills (Redmon & Burger, 2004).

When we consider all of these aspects of teaching and learning, it is apparent that there is the potential for the role of knowledge gatekeepers to alter significantly through the adoption of Web 2.0 technologies. The open nature of blogs and discussion forums is likely to diminish the degree of information filtering by knowledge gatekeepers; more information may be available, but volume does not guarantee quality.

The study

This study started as a pilot involving students undertaking a knowledge management course. An aim of this knowledge management course was to give students an understanding of the process of knowledge transfer between different groups and individuals who have differing perceptions of the meaning of the information transmitted and the collaborative measures needed to transfer and acquire that knowledge. The students were located on two separate campuses, and in three separate classes. As part of the assessment strategy, the students were responsible for creating and populating a single knowledge repository for the three classes, used in place of a formal, set textbook. To accomplish this task the students needed to communicate with each other (in small groups) with each group consisting of students from each class and campus. The students used social networking software such as chat room and discussion boards as part of the learning management system used by the university.

The success of the pilot led to the same communication strategy being utilised in other courses to equal success, and the extension of the research project to include those courses. To test potential variations in perceptions other third year courses were used, this time with the students studying in an information systems project-

based course. We returned to the knowledge management course in 2007, and particular attention was paid to the aspect of visual versus written versus verbal communication, and its relationship to the students' understanding of the subject material.

The underlying research methodology is action research and its iterative nature lends itself to the strategies employed in educational environments to plan and present the course material over a number of years: action research is "a participatory, democratic process concerned with developing practical knowing" (Reason & Bradbury, 2001, p.1). In terms of the research reported here, the framework that was used is an example of practical action research combined with emancipatory action research (Grundy, 1982), offering the opportunity to change the actions of the participants away from traditions, develop theory and improve practice at the same time.

The research is based on a five-stage model proposed by Susman and Evered (1978). In this model, the five stages identified are: diagnosing (identifying the problem that is to be addressed), action planning (determining how the problem can be addressed), action taking (in the organisational setting), evaluating (determining effects), and specifying learning (developing or modifying theory). In a critique of action research models, McKay and Marshall (2001) studied four action research process models and showed that they all involved one type of cycle, even though iterations may be involved. McKay and Marshall then differentiated between the processes involved with solving the operational problem (the real world problem being solved) and the cycle involved with knowledge acquisition (the research), and recommended that the research techniques used in knowledge acquisition (which takes place concurrently with the operational processes) be explicitly identified. With this recommendation to recognise the two parallel activities in action research in mind, the stages used in this research were situation diagnosis and theory application evaluation, planning, application to the learning situation, evaluation of outcomes and theory modification. Each year that the knowledge management course was presented was treated as an iteration of the cycle, as each presentation provided the opportunity to reflect on what had occurred in the previous semester and make changes with the view to improving student learning.

The data for this paper are, first, from online surveys via the course learning management system: based on the responses from the first survey, the same question set was offered in eleven different classes over three years. Student participation was invited via the course website with the responses being anonymous. The second set of data (for 2007) used was drawn from anonymous feedback on the unit content and teaching, as there was no separate data collection.

Participants

The original participants were students in a third year undergraduate capstone course and the age range was generally 18–24. This is an important aspect of this study because as students have noted in feedback to the authors, the courses used interactive tools differently from other courses: the tools were of their generation. Students today expect to use such tools as email, chat, blogs for communication and the students appeared to feel some ownership of the technology, perhaps because of the generational aspect. The extended study also involved third year students, this time undertaking group based information systems development (ISD) projects in collaboration with organisations with which the students had

found themselves. In 2007, the students were part of the third-year knowledge management class.

Results

Students' perspectives of knowledge gatekeepers

Bagozzi, Dholakia, and Mookerjee (2007, p.98) report on a study of online environments and social influence in recreational settings and claim

> *Participation by members therefore is **the** important shaping force of the group's character and determines not only its influence on the members but also the status and influence of individual members within the group. (Emphasis in original)*

Turniansky and Hare (1998) suggest that if group members exercise influence, interaction, and knowledge sharing when participating in decision-making activities, they are more likely to be committed to the outcomes decided.

There is evidence from the data that the students each had roles within each group and that some of those roles overlapped to other groups. This may have been because of the natural social networks amongst students and this cross-group influence caused those students to become the natural bridging agent between the groups.

The data also suggest that the students' perspective on the role of knowledge gatekeepers changed over the course of a semester. In one of the early semesters of the study at the beginning to the data collection, students appeared to feel that knowledge gatekeepers are appointed formally, whereas by the end of the semester the opinion had changed as is shown in Figure 2.

Figure 2: Student opinion to formally appointed knowledge gatekeepers
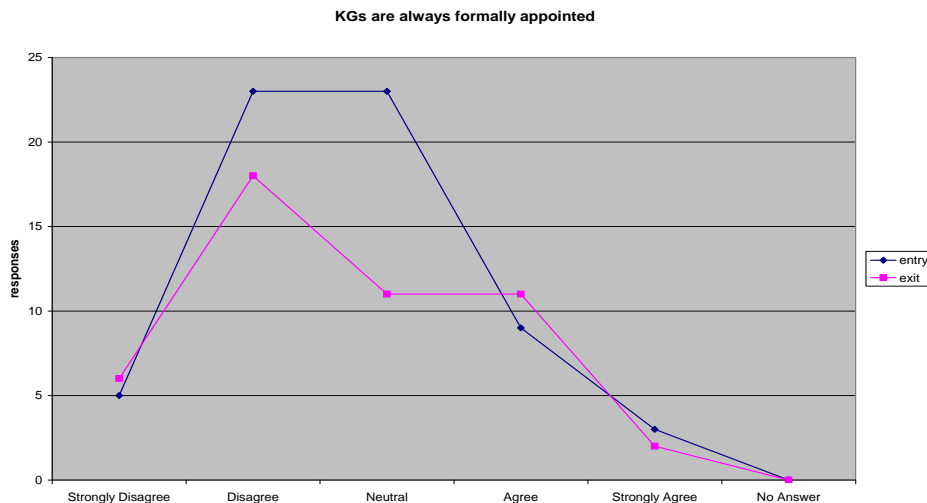
This was a significant step forward in the thinking processes of the students as it enabled them to evaluate their own perceptions across the duration of a course, and to reflect on those processes, thereby enabling knowledge building and a shift to a position of greater understanding of the knowledge gatekeeper interaction.

Use of blogs, chat rooms, discussion boards

Communication is an important aspect of e-learning; and e-learning environments need designing and testing before use to ensure that the students receive the best

experience available to them. It is not a simple matter of posting course materials on the course website and expecting the students to access them at a time convenient to them (Wells & Brook, 2008). The social aspect of learning has become essential in recent years, particularly so in online education and Web 2.0 supports interaction by enabling collaboration and participation through technically and socially open applications and services (Downes, 2005). In this study, not all classes used all of the Web 2.0 tools: some used chat room and discussion boards, while others used blogs and wikis, and another used emails and blogs.

Early iterations of the knowledge management class used chat rooms to discuss weekly course topics set by the lecturer, and each chat session lasted one hour. The students formed into self-selecting groups with a maximum of six members, as this number of participants was thought to be relatively easy to manage and small enough to allow each member to share their thoughts during the time of the online session. If the group was larger there was potential for sub-groups to form and this would have changed the dynamics of each group (Napier & Gershenfled, 2004). Each session was facilitated by an online tutor who encouraged and re-directed the conversations if the students strayed too far from the topic under discussion. Discussion boards were the means used to communicate to the class community. The ISD project classes used a class discussion board for class communication and group pages/boards for communication amongst group members.

Blogs can be interactive tools to foster students' interest and learning as peers comment on the each other's reflections by extending the classroom into the virtual world; or they can be static documents posted as an electronic version of the "old" reflective diary. From the feedback received through both the anonymous surveys and informally during the classes, it was apparent that the students saw the use of blogs as useful to their learning: by being able to interact "at will" they could meld their study with other activities or when time was available. Overall, it is the authors' impression that the quality of the comments is better using blogs than if issues are raised (for the first time) in class. This was especially the case where the multi-media aspects of the tool were used. Acting on the feedback from a student requesting an even more interactive learning style, the knowledge management class in 2007 used images as a means to share knowledge.

Use of images

In 2007, the particular focus was the use of images as a means to overcome the language barrier (in itself a means of retarding the sharing of knowledge). This leveraged Web 2.0 technologies, in particular the use of the blog tool of WebCT, which supports the inclusion of images along with words. Even allowing for the enforced nature of the use of the medium, the attitude (and results) of the students was significant. Comments from the (anonymous) student evaluations especially highlighted the motivational aspects of the class: *"keeps my attention"*, *"engaging"*, *"... highly encouraged class discussion and student participation"*, and *"... discussion which tends to be more valuable and interesting."* In relation to the use of the online tools, comments were in the vein of *"... online participation was a great way of learning and contributing your knowledge."* As an observation from the viewpoint of the teacher, it was quite apparent that the students were more engaged, participated more often in class discussion and understood the ideas being discussed, compared to the more traditional forms of teaching. Knowledge gatekeepers take many forms, including language barriers, and the use of different media to explore the course material appears to be an effective way of bringing different student understandings (their knowledge) out for others to share.

Discussion

Learning outcomes

Knowledge building in communities is a social activity undertaken by peers, and when that community of learners is online, there is a high probability that not all members of the community know each other as anything else than an online name and words typed as a reflection of their individual thoughts on a topic. By using the online forums to share and transfer knowledge, this knowledge becomes public knowledge in a social dimension (Scardamalia & Bereiter, 1996). One successful aspect of holding online discussions and blogs is that it allows the students to build their self-confidence in their own knowledge by freely exchanging thoughts and concepts on topics. Student comments, such as *"brought different perspective out in the open"* were gathered from the survey responses and semester feedback to teaching staff support our observations. Other student comments, such as *"facilitated understanding of subject matter in order to foster collaborative discussion and knowledge sharing through or providing their knowledge on the subject"* and *"help understand and explain ideas through conversations, and helped build ideas and grow knowledge"* indicated that they were appreciative of the opportunity to share their thoughts.

Figure 3 shows our interpretation of the knowledge transfer process and the bi-directional flow of that knowledge as it occurred in the different classes.

Figure 3 Knowledge transfer process (adapted from Armistead, 1999)
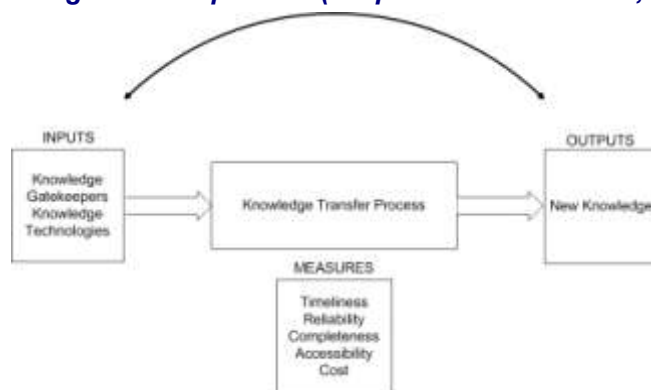
One of our aims as teachers is to move away from the concept that education is about students receiving what teachers provide, to opening up to students the thought that learning is a process of exploration and sharing. By exploration, we mean the processes involved in problem formulation, determining what information *may* be relevant, seeking out information and assessing it. In the transmission model of teaching and learning, the teacher does most, if not all, of these processes; in a constructivist world, the students do it for themselves. What is apparent to us is that by sharing with others, students can be more effective in the overall learning process; and the feedback received from students supports this viewpoint.

Web 2.0 technologies can assist in the learning process, that is, the Knowledge Transfer Process as shown in Figure 4. In particular, enabling students to communicate with each other using blogs and chat rooms provides an environment with which they are comfortable and used to from their social interactions. In a social setting, the information shared may well be trivial (in the educational sense), but by demonstrating the applicability of the familiar in a more formal educational

setting, the hope is that the students will be encouraged to continue to share (educationally relevant) information. Therefore, we see the use of Web 2.0 technologies as part of the learning infrastructure of the modern student, a student who is more used to Internet-based systems than any previous generation.

From the perspective of knowledge gatekeepers, it is apparent that their role has changed by Web 2.0 technologies. No longer is it necessary, and possibly not desirable, for the teacher to be the only determinant and repository of what knowledge the students will acquire. The students themselves become knowledge gatekeepers as they acquire, filter, and pass on the information they have. Indirectly, Web 2.0 technologies and the concept of knowledge gatekeepers are developing in students the ability to both express themselves and to be selective in what they share.

The role of knowledge gatekeepers

The roles of student knowledge gatekeepers can be broadly categorised into two groups: those issues concerned with students who want to keep knowledge to themselves so that they can gain a possible advantage in assessment tasks, and those issues associated with students who have knowledge but do not feel confident in sharing their knowledge. Web 2.0 technologies can assist in resolving the negative aspects of this behaviour, although it cannot "solve" all of the problems.

One role that the knowledge gatekeeper undertakes within a group is that of promoter or initiator of interaction with peers (Hauschildt & Schewe, 2000). By assuming this role, certain students acquired "a mantle of power" as perceived by other students, though after a relatively short period, this mantle passed to other students whose understanding of the topic under discussion was more comprehensive. This hand-over did not happen in all cases, but as one student observed, *"everyone can be a knowledge gatekeeper; depends really are they experts. If no, then they can communicate their ideas and facilitate as knowledge gatekeepers."* This observation gives the student knowledge gatekeeper an additional role: that of translator. This facet of knowledge gatekeepers arises especially when there is a great deal of ambiguity or barriers to understanding concepts (Holden & Kortzfleisch, 2004).

Often, the role of the gatekeeper links to innovation in products or processes (Hauschildt & Schewe, 2000), and in the case of this study, the innovation, as the students understood it, was enabling them to facilitate and participate in deciding what information they should acquire to build or create their own knowledge. By enabling the students to go through the processes of knowledge building in such an explicit manner, the students gained knowledge of the process rather than knowledge about the process (Scardamalia & Bereiter, 2006).

The knowledge gatekeeper role for the teacher becomes more and more that of a facilitator, guide, or storyteller who supports the student groups, rather than the perception of a sage-on-stage role that face-to-face teaching often engenders.

Use of Web 2.0 technologies for teaching and learning

In the first formal iteration of this study, anonymous postings to the discussion boards and chat rooms were disabled and therefore all activity was transparent to all students. When comparing the use of blogs, discussion groups, etc., to earlier uses of static repositories to store student contributions, the interactive and public nature of the Web 2.0 medium makes it more readily apparent if some students are not contributing. It is not yet clear whether this aspect of the medium encourages

greater participation, or whether it relates more to the allocation of rewards for participation. Assessing the student work itself becomes problematic as the less direct contact there is with the student; the more difficult it is to assess the work (Gayo, Gil, Alvarez, & Chigne, 2003).

Web 2.0 technologies do appear to have a significant impact where there is low participation due to lack of confidence. Familiarity with the medium and interaction with peers does seem to make students who would otherwise be reluctant to contribute to offer their opinions. The key here appears to be the extent to which the teacher /facilitator stays out of the discussion (at least initially) enabling free rein to ideas. The problems associated with language also appear to be addressed by utilising multi-media; this study has shown that the use of images "frees-up" ideas—students are actively encouraged to (literally) see the different aspects of a topic.

Figure 4 A model of collaborative learning, (Wells & Brook, 2004)
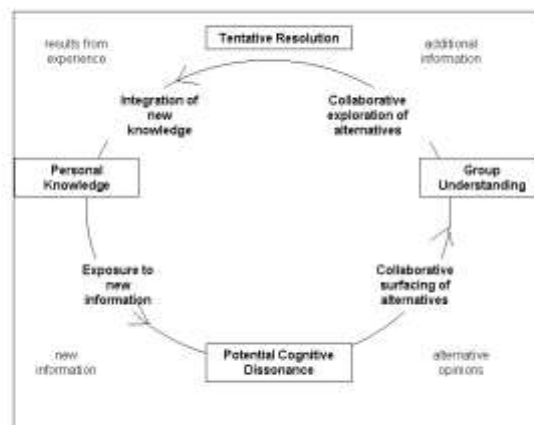
Collaborative learning supports social interaction and promotes learning through exposure to new information, and collaborative learning in small groups means that the groups can interact comparatively autonomously (Cohen, 1994). Student comments in the survey responses indicated that most students felt that knowledge gatekeepers arose at varying times in the separate groups depending on the topic under discussion and that particular individual's interest in that topic. As one student noted in relation to his/her group, "*not one particular individual stood out as a knowledge gatekeeper. Individuals each possessed knowledge of different fields, so in essence all individuals were knowledge gatekeeper at a particular instance.*" As expected, most students named the lecturer or online tutor as a knowledge gatekeeper.

The place of Web 2.0 technologies and the role of the teacher/facilitator have become clearer from this study. Using the cycle of collaborative learning shown in Figure 4, it is apparent that being able to share ideas amongst themselves (that is, without the direction of the teacher/facilitator) enables students to relate peer-to-peer in their own language and world-view in order to explore ideas. While the exposure to new information is one of the purposes of university, unless it is apparent that this information is indeed relevant students may not engage at a deep level to explore ideas in their own terms with their peers. The opportunity to engage peers can cause cognitive dissonance before the student resolves the

dissonance, (Figure 4) as the relevance of the information becomes more apparent. In a similar fashion, the exploration of alternatives is facilitated by interaction with their peers and those alternatives again offer the opportunity of the collaborative learning cycle.

Overall, this study points to a positive role for Web 2.0 technologies in addressing the issues of knowledge gatekeepers in knowledge sharing. As a cautionary note, care needs to be taken in the management of the learning experience (such as rewards) and in the social backgrounds (as in language and ethnic grouping), in order to keep expectations realistic.

Summary and recommendations

The authors see this study as evidence that blended learning (defined here as the use of two or more modes of teaching) has, and will continue to, change the way education is conducted. However, it is imperative that any teaching and learning approach be based in sound pedagogy, for while the technology may be an enabler, in the end it is only a tool. In some quarters, the technology is being seen as an answer to falling funding and increasing demand; hence the support for adopting Web-based teaching and learning technologies. We would argue that this in an important way misses the point of education, and indeed, may be detrimental. We would consider that effective education arises when the learning styles and motivations of those involved are used to form a teaching and learning approach, using whatever technology (or none) as appropriate.

Further work

To test the usefulness of multi-media as an additional medium for eliciting students' views, in 2008 the same technique will be used in two classes concerned with the management of innovation, change, and entrepreneurship. As well as images, other media will be used as a basis for student contributions to a blog and subsequent tutorial-based discussions as a group. Based on the outcome of this, a better insight into the applicability of Web 2.0 technologies to the traditional classroom (as opposed to distance education) is envisaged.

One challenge for the future is to re-examine the pedagogical basis of online teaching and learning. Much of the research to date has espoused the constructivist approach (that is, based on collaborative learning, meaningful tasks, communication, and a sense of belonging to a learning community). More recently, Siemens (2005) has proposed a pedagogical model based on connectivism: recognition of the need to be able to quickly react to changing circumstances, be very selective in which information to pay attention to, and to recognise that existing assumptions are no longer valid. The underlying idea is that learning is about building new connections between existing information and newly discovered information, in order to use it effectively, and Web 2.0 technology ably supports this goal.

References

Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning? *EDUCAUSE Review,* March/April ed., 33–44.

Allen, K. (2005). Online learning: constructivism and conversation as an approach to learning innovations. In *Education and Teaching International* Vol. 42, (pp. 247–253).

Arbaugh, J. B. (2002). Managing the on-line classroom: A study of technological and behavioural characteristics of web-based MBA courses. *Journal of High Technology Management Research*, 13, 203–223.

Armistead, C. (1999). Knowledge management and process performance. *Journal of Knowledge Management*, *3*(2), 143–154.

Bagozzi, R. P., Dholakia, U. M., & Mookerjee, A. (2006). Individual and group bases of social influence in online environments. *Media Psychology*, 8, 95–126.

Brown, J. S., & Adler, R. P. (2008). Minds of fire: Open education, the long tail and learning 2.0. *EDUCAUSE Review* Vol. January/February.

Clover, D. E. (2006). Out of the dark room: Participatory photography as a critical, imaginative, and public aesthetic practice of transformative education. *Journal of Transformative Education*, *4*(3), 275–290.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small Groups. *Review of Educational Research*, 64(1), 1-35.

Cranefield, J., & Yoong, P. (2007). The Role of Translator/Interpreter in knowledge transfer environments. *Knowledge and Process Management*, *14*(2), 95–103.

Christopherson, K. (2007). The positive and negative implications of anonymity in Internet social interactions: "On the Internet, nobody knows you're a dog." *Computers in Human Behavior*, *23*(7), 3038–3056.

Downes, S. (2005). E-Learning 2.0. *eLearn Magazine*.

Gan, Y., & Zhu, Z. (2007). A learning framework for knowledge building and collective wisdom advancement in virtual learning communities. *Educational Technology & Society*, *10*(1), 206–226.

Gayo, J. E. L., Gil, J. M. M., Alvarez, A. M. F., & Chigne, H. S. (2003). A generic e-learning multi-paradigm programming language system: IDEFIX project. In conference proceedings *34th SIGCSE Technical Symposium on Computer Science Education*, Reno, Nevada, USA.

Grundy, S. (1982). Three modes of action research. *Curriculum Perspectives*, *2*(3), 23–34.

Ham, V., & Davey, R. (2005). Our first time: two higher education tutors reflect on becoming a 'virtual teacher'. *Innovations in Education and Teaching International*, *42*(3), 257–264.

Harada, T. (2003). Three steps in knowledge communication: the emergence of knowledge transformers. *Research Policy*, 32, 1737–1751.

Hauschildt, J., & Schewe, G. (2000). Gatekeeper and process promoter: Key persons in agile and innovative organisations. *International Journal of Agile Management Systems*, *2*(2), 96–103.

Holden, N. J., & Kortzfleisch, H. F. O. (2004). Why cross-cultural knowledge transfer is a form of translation in more ways than you think. *Knowledge and Process Management*, *11*(2), 127–136.

McKay, J., & Marshall, P. (2001). The dual imperatives of action research. *Information Technology & People, 14*(1), 46–59.

Miles, S., & Kaplan, I. (2005). Using images to promote reflection: an action research study in Zambia and Tanzania. *Journal of Research in Special Education Needs*, 5(2), 77–83.

Napier, R. W., & Gershenfeld, M. K. (2004). *Groups: Theory and experience* (7th ed.). Boston: Houghton Mifflin Company.

O'Reilly, T. (2005). What is Web 2.0: Design patterns and business models for the next generation of software? Retrieved February 3, 2007, from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Prensky, M. (2004a). *Use their tools! Speak their language*. Retrieved April 8, 2008, from http://www.marcprensky.com/writing/Prensky-Use_Their_Tools_Speak_Their_Language.pdf

Prensky, M. (2004b). *The emerging online life of the digital native: What they do differently because of technology, and how they do it*. Retrieved April 8, 2008, from http://www.marcprensky.com/writing/Prensky-The_Emerging_Online_Life_of_the_Digital_Native-03.pdf

Reason, P., & Bradbury, H. (2001). Inquiry and participation in search of a world worthy of human aspiration. In P. Reason & H. Bradbury (Eds.), *Handbook of action research: Participative inquiry and practice*. London: Sage.

Redmon, R. J., & Burger, M. (2004). WEB CT DISCUSSION FORUMS Asynchronous Group Reflection of the Student Teaching Experience. *Curriculum and Teaching Dialogue*, 6(2), 157–166.

Reinsch, N. L., & Turner, J. W. (2007). Ari, R U There? Reorienting business communication for a technological era. *Journal of Business and Technical Communication*, 20(3), 339–356.

Saab, N., van Joolingen, W. R., & van Hout-Wolters, H. A. M. (2005). Communication in collaborative discovery learning. *British Journal of Educational Psychology*, 75, 603–621.

Scardamalia, M., & Bereiter, C. (1996). Rethinking learning. In D. R. Olson & N. Torrance (Eds.), *The handbook of education and human development: New models of learning, teaching and schooling* (pp. 485–513). Cambridge, MA: Basil Blackwell.

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *Cambridge handbook of learning sciences*. Retrieved February 15, 2007, from http://ikit.org/fulltext/KBTheory.pdf

Schwartz, H. (1996). The changing nature of teacher education. In J. Sikula, T. J. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education* (2nd ed., pp. 3–13). New York: Macmillan.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*, 3–10.

Stephenson, K. (1998). What knowledge tears apart, networks make whole. *Internal Communication Focus*, 36.

Suler, J. (2004), In class and online: Using discussion boards in teaching, *CyberPsychology and Behavior*, 7(4), 395–401.

Susman, G. L., & Evered, R. D. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly, 23*(4), 582–603.

Turniansky, B., & Hare, A. P. (1998). *Individuals and groups in organisations*. London: Sage Publications.

Walther, J. (2007), Selective self-presentation in computer-mediated communication: Hyperpersonal dimensions of technology, language and cognition. *Computers in Human Behavior*, 23(5), 2538–2557.

Wells, M. A., & Brook, P. J. W. (2004). Conversational KM – Student driven learning. In conference proceedings *Sixth Australasian Computing Education Conference (ACE2004),* 18–24 January, Dunedin, NZ.

Wells, M. A., & Brook, P. W. J. (in press). Self-service and e-education: The relationship to self-directed learning. In C. Romm-Livermore, D. Oliver, & F. Sudweeks (Eds.), *Self-service in the Internet age*. London: Springer-Verlag.