THE WIKI FACTOR: HOW STUDENTS LEARN TO LOVE GROUP WORK

Charlotte Brack
Faculty of Medicine, Nursing and Health Sciences
Monash University
Australia

Marie-Paule Van Damme
Department of Biochemistry and Molecular Biology
Monash University
Australia

Abstract

We explore the use of social software to enhance online collaboration of undergraduate students in higher education. This was implemented within Leapfrog Biology, an intensive 4-week online program developed for students who have not completed year 12 biology and who are entering first year medical studies. We used wikis to facilitate both the process and the product of collaboration. We consider the educational design of the online environment, the underlying pedagogy and student activity, and the ways in which the design influences student satisfaction, motivation and learning outcomes.

Introduction

The Internet was spawned by the desire of people (computer programmers) to communicate via computer. Software for e-mail, discussion boards, groupware and the like allowed users to interact and communicate online. However, it took the development of Web 2.0 technologies (O'Reilly, 2005), which enabled users to modify content online, for online collaboration to move towards a new definition for group work. Web 2.0 or 'social software', so called because of its facility for communication, interaction and activity, gives power in online collaboration directly to members of social groupings without the need for intermediary technical experts (Shirky, 2008).

In designing a biology bridging course we wanted students to have opportunities to collaborate. The social software of wikis provided a mechanism for students who were unable to meet face to face to engage in group project work, with a structure and a place to get to know each other and to work together online. Thus issues of collaborative skills, peer learning, and information and communication technology (ICT) skills as well as biology content were included in learning outcomes.

Background

At Monash University (Australia) medicine is offered as an undergraduate course; however, over 50% of students entering the course in first year have not completed biology as it is not a prerequisite. These students are at a disadvantage when they start medical studies and report feeling confused by terminology and concepts. In 2006 we implemented, for this group of students, an online biology bridging course called "Leapfrog Biology" so-called in reference to the popular beach game of leapfrog with the idea of getting over a hurdle. Leapfrog Biology was not compulsory but students who had not taken year 12 Biology were strongly advised to enrol. The content of the course is based on the Victorian year 12 curriculum. A pedagogy based on active learning was incorporated through student engagement in authentic activities (Honebein et al., 1993) to provide real-life contexts in relation to medical science.

The scheduling was dictated by the timing of student acceptance of offers four weeks prior to the start of first semester. At this time students are committed to employment and vacation activities, with many interstate and overseas students; and are unable to attend the campus. The course is run online to accommodate the circumstances of students.

Student Collaborative Learning

Collaborative group work provides a powerful context for student learning in higher education within a social constructivist paradigm, which based on ideas of Vygosky (1978), describes learning as a social process. The success of collaborative group work for learning is highly dependent on the context in which it is implemented (Bower & Richards, 2006). Collaborative group work based on a 'community of practice' provides an environment where a group of students engage in shared activity around a domain of knowledge (Wenger, 2002). Students communicate and work together on an activity designed to facilitate their construction of meaning and understanding around the domain of knowledge. In addition to their value for learning, proficiencies in communication and collaboration are life skills often included in statements of attributes of graduates in higher education (Barrie, 2004).

Implementing collaborative learning presents challenges, the most significant of which is that of student perception. Students often dislike group work which does not recognise different levels of contributions from individuals (Falchikov, 2005; Gatfield, 1999). Studies of attitudes of first year students to group work revealed an acceptance of its value for learning but concern and dissatisfaction over the issue of 'passengers', students who made little contribution but benefited from the work of the group (Bourner et al., 2001). Self- and peer assessment schemes have been used to address this issue with varying success. These schemes rely on

student reporting on their contributions and those of other students in their group. As this reporting is subjective, Li (2001) used a 'normalisation factor' to account for bias and concluded that while well received by students, it was useful only as a reference for staff in distributing group marks. In considering self and peer assessment as a core attribute for professionals Raban and Litchfield (2007) devised an online scheme for such assessment. They questioned its value in assessing individual contributions but concluded that it was useful in terms of group dynamics and learning outcomes.

A further challenge is one of scheduling. Engaging undergraduate students in collaborative learning has become increasingly difficult due to large class and timetabling issues which limit opportunities for face-to-face interactions in small groups. The increasing familiarity with online communication and the use of social software provided opportunities for our course.

Social Software and Collaborative Learning

In discussing social software for learning Leslie and Landon (2008) describe characteristics which make it especially suited to online learning. In addition to its social aspect, these characteristics include the degree to which it taps into the user's motivation; helps build authentic online identity and authentic learning experiences; builds networks of affinity and the emergence of connected knowledge; and encourages peer production and review. These characteristics relate closely to those of a community of practice translated to the online environment. Hoadley and Kilner (2005) offer a model termed C4P where elements of content, conversation, connections, and (information) context respond to purpose of a community of practice. They link this with a distributed cognition framework drawing on the advantages of online technologies of representation, process and social context. Dron (2007) explores social software in education in terms of a shifting balance of control towards students.

In the higher education context the social software of wikis has been used in writing assignments and in group projects where students collate information (Parker & Chao, 2007). Students create a knowledge repository akin to arguably the most extensive wiki, Wikipedia (www.wikipedia.org). These applications draw on the value of online editing enabling production of a body of work. But a wiki is much more than a repository, a body of work, a product. Unlike other forms of group work the wiki itself contains a record of the collaborative process. It holds a record of discussion between group members as well as a record of its evolution. Shirky (2008) describes this aspect as stigmergic in nature drawing an analogy to the pattern ants leave from which the term is derived. By incorporating communication between students as an integral part of their activity the wiki reveals a more collaborative environment. The recording of collaborative process as well as product makes individual contributions to collaborative work

transparent and brings a new level of validity to assessment. We have used wikis which record and preserve edit histories and discussions, to observe and assess contributions of individuals and assess the process as well as the product in online collaborative student projects. We have successfully used this approach in different contexts within interactive case-based programs for medical and biomedical students (Brack et al., 2007).

From studies of collaborative group work with postgraduate students Elgort et al. (2008) concluded that while students and teachers viewed wikis as a valuable way to collaborate, it is not the 'tool' itself that promotes collaboration. This echoes conclusions across the range of technologies used in education that the design of the environment and the context are the key to successful learning.

The prevalence of social software suggested that students would be familiar with and proficient in its use. Prensky (2001) views Generation Y as the "net generation" describing them as "digital natives." However, Kennedy, et al. (2008) found that first year medical students varied considerably in their use and preference for technologies. Thus scaffolding to support students with a wide range of information and communication technology (ICT) skills is needed.

Educational Design

Leapfrog Biology is an intensive 4-week online program which incorporates individual self-directed learning material and activities and collaborative online projects. The individual program was implemented through the university Learning Management System (LMS). Learning was scaffolded in an open structure designed to encourage higher order thinking. Learning materials were offered in three modules based on themes aligned with those of first-year medical studies: The Cellular Basis of Life; Human Genetics; and Infection, Disease and Immunity. For each module there were 14 to 20 activities (including multimedia, quizzes), complementary text and a self-assessment quiz. Collaborative group work included a debate and a competition between groups called "the Nobel Factor." Students commenced by engaging in a debate on the topic of Stem cells. Each group used the social software functionality of wikis to create a site exploring Nobel Prize winning discoveries in stem-cell research relating to the topics of the modules. The wiki facilitated networking and peer learning via discussion and enabled students to produce and refine a body of work through progressive editing.

A private wiki was set up for each group in 'Wikispaces' (www.wikispaces.com). Wikispaces was chosen because of its simplicity in terms of management, ease of use, rapidly responding 'helpdesk' and availability of private spaces. Students controlled membership of their wikis and could open them for all to read (i.e.,

make them public) at the end of the project. Editing was easy to master and discussion spaces were threaded. Wikis becoming available in existing LMSs offer an advantage of incorporation with other learning materials and functions but their identification tends to be with the course rather than the group owners.

From 2006 to 2008 the course was introduced and run completely online. Early online chat sessions supported students in setting up their wikis. In a 'Getting started' section students were introduced to the course, our role and expectations and given guidance in working in groups. In 2009 a two-hour face-to-face orientation session was introduced to brief students on expectations of the course, its resources and support.

Evaluation

In 2009 an extensive evaluation of student perceptions of several aspects of the course, was conducted by survey. In particular the survey analysed how students collaborated online and explored how the technology contributed to motivation, group dynamics and identity, and facilitated development of students' collaborative and problem solving skills. Analysis of page histories and discussion contributions provided evidence of how groups worked to create communities of practice.

Results

In 2009 there were 132 students enrolled in Leapfrog Biology. Informal survey indicated that no students had experience editing wikis, although they had used Wikipedia as a source of information. Most students accessed the course from their place of residence via broadband connection. A high proportion of students (42%) responded to the online evaluation survey, far above the average response of 25%.

Despite the non-compulsory nature of the course more than 60% of enrolled students substantively participated in the debate discussion and engaged in wiki (Table 1); 68% of students who signed up for wikis engaged with them. Reasons given for lack of engagement in group activities ranged from lack of Internet access over the period of the course to lack of time.

Table 1: Participation in Social Software Opportunities

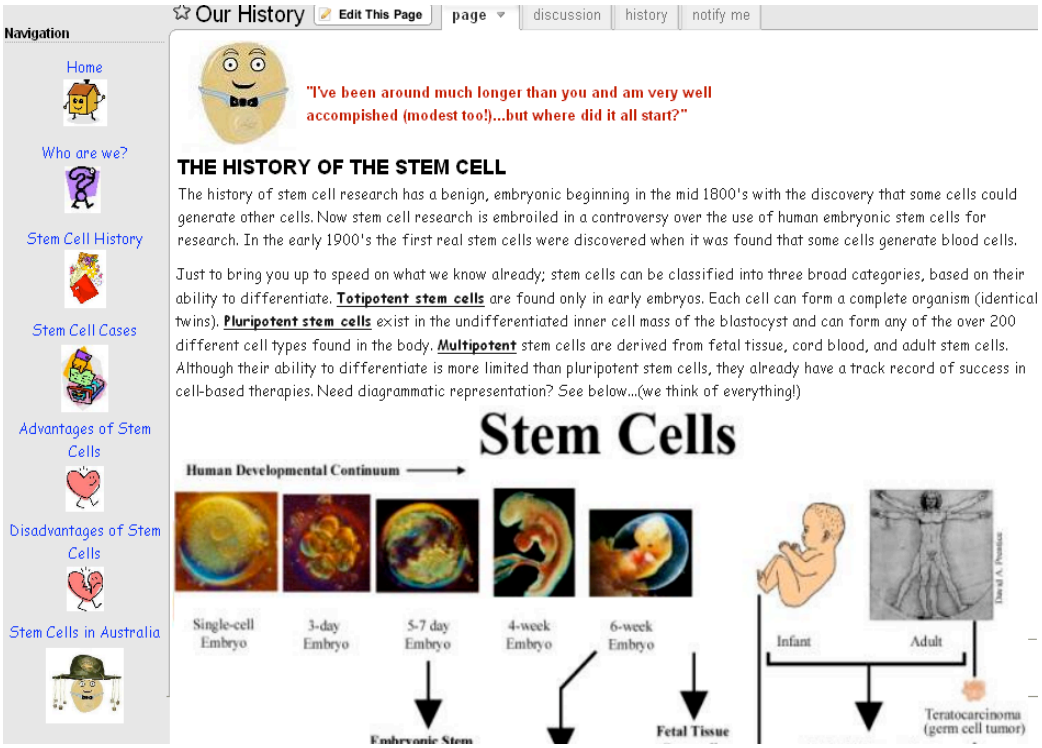
In 2009	**Number of students***	**% of enrolled**
Total engaging in debate discussion space	105	80
• social introduction only	22	17
• substantively	83	63
Signing up for wiki	120	91
Engaging in wiki	81	61
** 132 students enrolled for Leapfrog Biology in 2009*		

Considering that the course was run before the start of the semester, during University holidays, data in Table 1 show students had a high commitment to the course.

Considering the Product

The wikis produced by student groups for the Nobel Factor ranged from simple single page sites of text to complex multipage sites with text, images, video and sophisticated navigation. They defined terms in stem cell biology, explored the ethics of stem cell research and responded to specific questions raised in the context of the Leapfrog modules. Figure 1 shows the home page of the winning wiki. The menu (on the left) shows some of the links to areas of the site indicating the complexity of this project. Wiki functionality is indicated in the tabs across the top of the screen.

Figure 1: Home Page of the Winning Wiki



Student Attitudes to Group Work

Survey of students indicated that social software gave them opportunities for networking and support that they valued (Table 2).

Table 2: Student Responses to Selected Survey Items

Survey item	**% of students agreeing**
Initially the idea of learning online was daunting	41
By the end of the course I felt more confident about learning online	70
I valued opportunities to make contact online with teaching staff and other students.	63
The social software (wiki) was an effective way to collaborate online	64
The wiki provided a rewarding way of presenting a project online	73
It was important that my contribution to the project could be assessed by staff	56

While 41% of students were initially daunted by online learning, their confidence had markedly increased by the end of the course. Almost three quarter of students found using a wiki rewarding. As the course was not compulsory, the project was not graded; yet over half of the class found it important to have their contribution assessed by staff.

Student responses to "What did you enjoy most?" often related to the collaborative nature of the course as listed in the quotes below.

- "The ability to design a website and through this activity build on my knowledge of stem cells and their uses"
- "Meeting other people online"
- "The interaction with other students"
- "The collaboration of work with other students"
- "Working in group and building friendships with others before starting class"
- "Getting used to learn via the Internet"

Considering the Process

Scanning wiki discussions revealed the ways in which students collaborated, including issues of organisation, enthusiasm and satisfaction. Table 3 gives some examples of different styles of student collaboration.

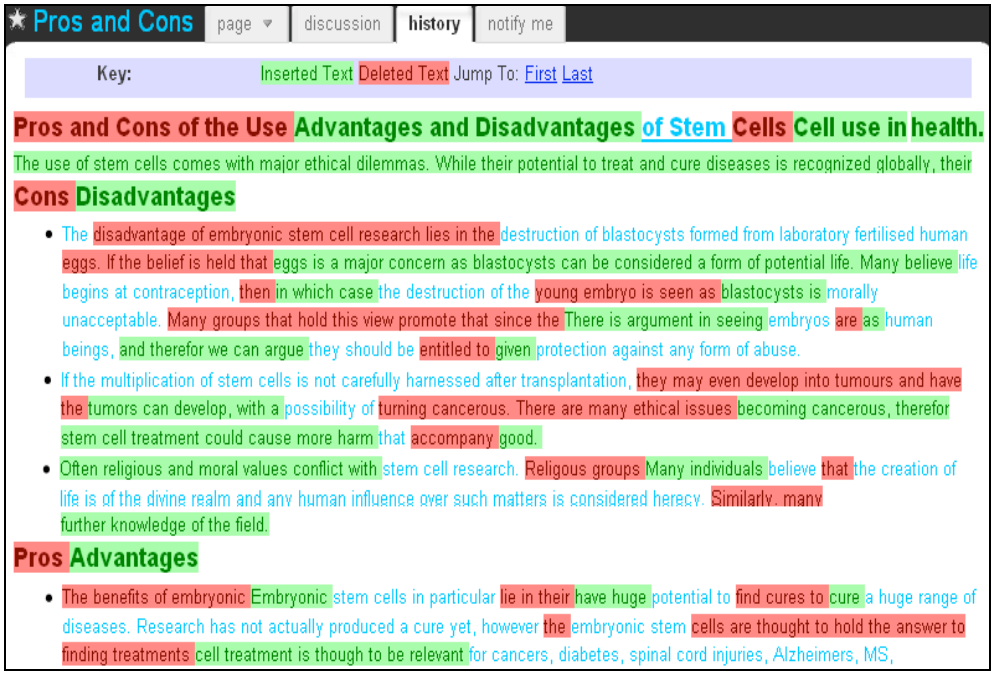
Discussion posts listed under 'Enthusiasm' and 'Satisfaction' indicate that students felt positively about their groups and group projects. Comments were unsolicited.

Table 3: Examples of Collaboration from Student Discussions

Aspect	**Examples:** direct quotes from student discussions
Organisation	We need to assign everyone a clear topic of research and decide our stance before we can start collating so that we don't waste time, get confused or duplicate our info. Don't forget to footnote !! What do u think if we choose one as leader and then every one say who want to do which part of research. This is just a list of what people seem to be doing/collated from all the other message boards. Just to see a summary but definitely not definitive. LK - Recent research done (2-3 in detail) + editing/layout (?) AE - Advantages RA - History + Definitions KN - Editing + benefits/dangers (?) LS - Disadvantages + Usage + Editing (?) RF - General Info/Home Page JM - Disadvantages BE - All round We can finish the final drafting maybe next Thursday? And start the editing/final corrections after that - finish Monday/Tuesday before camp? That way, we can all 'relax' sooner rather than later. I was just thinking whether we should just do a basic list/brainstorm/"points of debate" (etc) for the general points we have to cover (after everyone's up) so we know where we're heading? Maybe have a separate thread for each point? Does that sound okay?
Enthusiasm	I'm excited! Can't actually wait to meet you all in person! I had what I think is a super idea!! We could make the site in the perspective of a stem cell, like a day in the life of one stem cell and all its friends that get differenciated to other cells so we can go over anything!! EXCITING im getting really excited its looking great ! oh and i hear there will be more controversial articles re. stem cell research esp. in aust in the next week or so everyone look out.!
Satisfaction	So lovely to meet you! The research you've done so far is GREAT! our wiki is looking fantastic!!!!!! I'm so proud of everyone's work The whole wiki has worked brilliantly *I'm really feeling the love in this group...you guys are wonderful! I feel priveliged to have been able to work with you guys... Can't wait to meet each and every one of you!*

The collaborative process was further explored through wiki page histories. Figure 2 shows a comparison of two versions of a wiki page, indicating how one student edited work of others. From such comparisons the development of sites can be monitored.

Figure 2: Comparison of Versions of a Wiki Page



Learning Outcomes

The development of students' IT skills was evident in the structure and complexity of the wikis. From a position of no experience with the technology students rapidly grasped and mastered the abilities to edit and manipulate their wikis. Students' collaborative skills were also evident, both from the content of discussion and the rapidity of the development of the wikis. Consideration of the content of the wikis and its synthesis gave a measure of students' understanding of the biology of stem cells, suggesting they had developed a mature and sophisticated knowledge base. Furthermore, feedback from self-assessment quizzes in the modules showed a high average mark of 70%, indicating that students had mastered key concepts in biology.

Discussion

The extent and accuracy of information in wikis and the level of knowledge building evident in histories and discussion, indicated that the students gained an excellent understanding of biology through group work. The requirement for collaboration helped students develop skills in problem solving, communicating, planning and organising. The authenticity of the Nobel Factor project gave students the opportunity to develop their academic and ICT literacies. Some of the wikis produced for the Nobel Factor project in Leapfrog Biology were exemplars of good web design, well laid out, well researched, accurate and informative. This demonstrated that Leapfrog helped students gain familiarity with terminology and key concepts in biology. Each year we have used the winning wiki as a resource on stem cells for first-year medical students. The pride students take in their wiki and the commitment to their group comes through in their discussion posts. It is remarkable that students who have not yet met each other work collaboratively on a project which is not compulsory and contributes no marks to their first year studies.

The social constructivist basis for the educational design of the course was verified in particular through the competition, the Nobel Factor. The discussions of the wikis enabled students to share their excitement about their project wikis and enthusiasm within their group as well as to show their satisfaction with the group process and the wiki product. The last comment in Table 2 captures the mood of a particularly successful wiki in which 10 of the 11 members were active participants. Despite the large number of students they managed their group skilfully and productively and were awarded the Nobel Factor prize for 2009.

Social constructivism is also apparent in the way students collaborated in creating meaning through exploring the topic of stem cells. They researched aspects of stem cell biology and offered their results to the group. The pattern that emerged from scanning histories and comparing pages is one of contribution followed by consolidation. Students posted their responses to questions and issues, they then edited, merged and adapted the contributions with the synthesis of knowledge evident in considering the histories and discussions together. Wiki pages became far more than collated information with simple contributions of content from individuals. The combination of the discussion and page histories offers a unique opportunity to observe aspects of social constructivism in action.

Analyses of the process and the product of the Nobel Factor give clear evidence of the building and operating of online communities of practice, with shared activity around a domain of knowledge (stem cells) with construction of meaning. The project responds to the paired frameworks of learning in a community of practice (C4P: content, conversation, connections, (information) context and purpose) and

of distributed cognition which encompasses authentic individual and systemic elements in relation to use of online technologies (Hoadley & Kilner, 2005).

Not only did the technology facilitate the activity of collaborating it engaged students engendering considerable enthusiasm for the collaborative process. It would be interesting to explore the ways in which students worked differently because of the online technology. Some of the comments made in the discussions displayed considerable freedom of expression, possibly due to an element of safety of physical remoteness.

Conclusion

"I'm really feeling the love in this group . . . you guys are wonderful! I feel priveliged to have been able to work with you guys . . . Can't wait to meet each and every one of you!"

This extravagant comment from one student illustrates the enthusiasm with which they embraced the Nobel Factor project and the collaboration it required.

The educational design of the course provided the context in which students used social software for learning within an online community of practice. The partnership between the technology and the educational design provided a safe and supportive environment where students could appreciate their individual learning through collaboration.

And at the end of the Nobel Factor, students 'loved' group work and appreciated the opportunity to leap the hurdle and acquire a sound background in biology as summarised by one student *"The course was wonderful!! Thank you for helping out the Biology "virgins", even though it meant sparing a lot of your time; it was much appreciated."*

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