

Using wikis to help first year students develop collaborative knowledge management skills for tomorrow

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In the information economy the ability to harness digital technologies to capture and manage knowledge is a critical skill for university graduates. This study examines the use of wikis as an assessment tool to help first year students develop a range of knowledge management skills, including creative collaboration, consensus building and technical literacy. The purpose of the study is to provide an exploratory analysis of student attitudes toward the use of wikis as a collaborative assessment task. The results indicate that most students perceived wikis to be a flexible, convenient and fair pedagogical technique for collaborative learning. While many students preferred the wiki to a paper-based assessment, some students were not convinced that the task produced better collaborative outcomes. It is suggested that a staged wiki assessment might overcome some of the perceived shortcomings reported by students.

Introduction

The ability find, interpret, organise and create knowledge is a critical skill for university graduates. In an information-based, networked economy students leaving university also need to have attained skills in creative teamwork and to have developed critical, reflective practices (Bruns & Humpreys, 2005). Graduates who can present knowledge creatively using information and communications technologies (ICTs) are also in increasing demand. Biggs (1999) suggests that the increased emphasis on these transferable skills has required a reframing and rethinking of teaching practices to obtain desired learning outcomes. Several authors, writing about the role of ICTs in teaching and learning, have suggested that the ongoing evolution of Web 2.0 technologies such as blogs, wikis and podcasts offer new opportunities for developing information literacy and knowledge management skills (BizEd, 2007; Parker & Chao, 2007; Alexander, 2006).

The following paper will present a brief discussion of the emergence of Web 2.0 technologies and their implications for teaching and learning before focussing specifically on the use of wikis as a tool for developing knowledge management and information literacy skills. The paper then goes on to evaluate student responses to the use wikis as a learning activity in a first year business unit at a regional Australian university.

The Growth of Web 2.0 Technologies

The term 'Web 2.0' has received increasing attention in the popular media, particularly in the context of leveraging the explosive growth of associated technologies and brands for commercial purposes. Rather than being a 'new' version of the web as the term implies, Web 2.0 represents a shift or evolution in the way content is created, displayed and shared on the Internet. Web 2.0 allows users to share a variety of information, whether they're exchanging videos on YouTube, building a common base of knowledge using wikis, networking on MySpace or Facebook, or

sharing knowledge using blogs and podcasts. Tapscott & Williams (2006) describe how Web 2.0 has created web-based communities where mass collaboration is possible between geographically dispersed individuals who create, edit, and influence everything from the human genome project to the international media. This phenomenon, which they have called *wikinomics*, is based around four central tenets: openness, peering, sharing, and acting globally. The fact that these technologies are being actively embraced by some of the most successful ‘new economy’ companies suggests that universities need to play a more active role in preparing graduates for employment in the new economy.

From an information design perspective, Alexander (2006) suggests that Web 2.0 technologies break away from the page metaphor because information is predicated on blocks of content called *microcontent*. He observes that “blogs are about posts, not pages. Wikis are streams of conversation, revision, amendment, and truncation. Podcasts are shuttled between Web sites, RSS feeds, and diverse players” (p. 33). Microcontent can be easily saved, summarized, modified, copied, quoted, linked and built into new knowledge. The ease with which content can be manipulated has powerful implications for classroom teaching and individual learning. Some commentators have suggested that younger students have become reflexive users of Web 2.0 applications and will expect to use these tools to facilitate their interactions with education providers and employers (BizEd, 2007). This implies that students may want to read university blogs and use collaborative technologies such as wikis to build and share knowledge.

Wikis

Wiki is a contraction of the term *WikiWikiWeb*, which in turn is derived from the Hawaiian expression *wiki wiki* meaning *fast* or *quick*. Leuf & Cunningham (2001), creators of the original wiki concept, define a wiki as “a freely expandable collection of interlinked web pages, a hypertext system for storing and modifying information – a database, where each page is easily edited by any user with a forms-capable Web browser client” (p. 14). The open source online encyclopaedia *Wikipedia* is perhaps the best example of a wiki.

Wikis generally share the following basic characteristics:

- Most wikis are completely unrestricted, allowing anyone to correct, modify, complete, or even delete content. This system is self-regulating, with contributors readily correcting errors and modify content. However in a learning context wikis can be restricted to small groups of contributors. (Schaffert, et. al., 2006; Duffy & Bruns, 2006)
- Content can usually be edited from anywhere in the world through a simple web browser interface, obviating the need for additional software or a third-party webmaster (Schaffert, et. al., 2006; Schwartz, Clark, Cossarin & Rudolph, 2004)
- Content is usually created using a simplified hypertext format, making it easy for non-technical users to contribute. Some wiki technologies use a WYSIWYG interface with toolbars, completely removing the need for detailed technical knowledge (Schaffert, et. al., 2006; Ebersbach, Glaser & Heigl, 2006; Duffy & Bruns, 2006).
- Changes to content are documented and stored each time a revision is made, allowing users to view or revert to earlier versions of a page. This makes it possible to track changes by users over time. (Schaffert, et. al., 2006; Ebersbach, et. al., 2006; Duffy & Bruns, 2006).
- Pages in a wiki are usually linked with each other, allowing for organic connections between content areas (Schaffert, et. al., 2006). Ideas are expressed as relationships between pages, creating a network of interrelated topics (Ebersbach, et. al., 2006; Duffy & Bruns, 2006).

- Wikis have a spatial rather than temporal structure as changes occur not according to time, but according to the evolving relationships between cross-linked content (Duffy & Bruns, 2006).
- Content is posted immediately, eliminating the need for distribution with the associated risk of virus transmission (Schwartz, *et. al.*, 2004).
- Modular construction means that wikis can be simple or complex to meet user needs and skill levels (Schwartz, *et. al.*, 2004).

Wiki pages can be interconnected and organised as required because there is no inherent structure hard-coded into wiki technology (Duffy & Bruns, 2006). This makes wikis a flexible knowledge management space which promotes creative collaboration or ‘collective cognition’ – a process whereby several people attain insights that could not be achieved individually (Lund & Smørdal, 2006). The design is considered highly democratic, in the sense that every user has exactly the same capabilities as any other user (Carroll, Guzdial, Holloway-Attaway, Rick & Walker, 2002).

Wikis in Teaching and Learning

Duffy and Bruns (2006, p.1) claim that “the rapid development of digital technologies and their use in education enable individuals to interact within the educational domain in new ecologies of learning.” This view is supported by Reinhold (2006, p.47), who observes that “the idea of using technology and electronic media to supplement real-world classroom environments is currently undergoing a transition from afterthought to integral didactic element.”

Despite this enthusiasm for digital technologies, and the fact that wikis have existed for over a decade, their use is relatively new in academia (Evans, 2006; Schaffert, *et. al.*, 2006). While wikis can be used by students and educators as a source of information, they also provide a method of virtual collaboration allowing students to share information in group projects. Wikis allow students to engage in learning with each other, using the technology as a collaborative virtual environment to construct their knowledge (Boulos, Maramba & Wheeler, 2006). The ability to create, edit and restructure content allows students to represent data in a more organic format than asynchronous learning tools such as discussion boards and blogs (Choy & Ng, 2007). The non-linear structure of wikis allows students to make new connections between concepts, while the ability to use multimedia provides greater scope for expression (McPherson, 2006).

From a theoretical perspective, Parker & Chao (2007) suggest that the use of wikis appears to be particularly well supported by two key learning paradigms: the collaborative learning paradigm and the social constructivist paradigm. The *collaborative learning paradigm* is based on the notion that students work in heterogeneous groups to support the learning of individuals (Parker & Chao, 2007). The use of wiki assessment tasks have the potential to overcome some of the problems associated with traditional collaborative learning approaches. Wikis can make it easier to detect incidences of social loafing which typically cause students who feel that they have contributed more than other team members to develop a cynical attitude toward group assessments (Luca & McLoughlin, 2005). It is also evident that the current cohort of Generation Y students are increasingly constrained by employment commitments which are not conducive to face-to-face group meetings (Krause, Hartley, James & McInnes, 2005). These challenges indicate a need for flexible collaborative learning approaches where individuals can develop their skills as needed (on-demand learning) and when they have time (just-in-time learning). Benckendorff (2007) found that business students were enthusiastic about a range of flexible learning approaches which allowed them to better manage study and work commitments. While the utopian notion of ‘learning any time, anywhere’ has been difficult to achieve, recent advances in personal technology is making mobile learning more feasible. Wikis have the ability to

generate online collaboration and interaction amongst students who may be geographically dispersed. Although wiki technologies are useful for distance education, they are also particularly relevant in the context of blended delivery approaches (Reinhold, 2006).

The *constructivist paradigm* conceptualises learning as an active process where learners participate to construct knowledge and understanding (Boulos *et. al.*, 2006; Jonassen, Peck & Wilson, 1999). This contrasts with traditional approaches to university teaching which have relied on the transfer of information from instructors to students. The constructivist view considers learning to be a recursive, self-referential process in which learners interact with the environment, select and transform information, and construct their own knowledge (Parker & Chao, 2007; Reinhold, 2006). The constructivist paradigm has in recent decades been extended beyond a traditional focus on individual learning to address collaborative and social dimensions of learning (Bruns & Humphreys, 2005; Schaffert, *et. al.*, 2006). The notion of social constructivism suggests that students are not only engaged in developing their own information but are actively involved in creating knowledge that will benefit fellow students (Holmes, Tangney, FitzGibbon, Savage & Meehan, 2001). The role of social interaction as a mechanism for learning is often associated with Vygotsky (1978), who suggested that the thinking and learning processes of individuals can be traced to their interactions with others. As students collaborate on a wiki, the content moves through an evolutionary process which Boulos *et. al.* (2006) have called *Darwikinism*. This 'social Darwinian' process requires that unfit sentences and sections are ruthlessly culled, edited and replaced, resulting in the evolution of more relevant, higher quality content. The process of creating a wiki therefore requires students to understand the learning process by reflecting not only on their own work, but on the work of peers. Knowing that peers will be reading their work provides additional motivation for students to write more enthusiastically (McPherson, 2006).

Research Aims

The recency of the literature reviewed above is indicative of the growing interest in wikis amongst educators over the last few years. However, much of the literature is conceptual or descriptive and very few studies provide an empirical assessment of the issues associated with the use of wikis. While several studies have included feedback from students, this feedback is often anecdotal or based on observations made by researchers. The purpose of this study is to provide an exploratory analysis of first year student attitudes toward the use of wikis as a collaborative assessment task in a business unit. The specific aims of the study are to:

1. Examine first year students' views about the flexibility and ease of use provided by wikis;
2. Assess the extent to which wikis encourage collaborative learning and reflection; and
3. Evaluate the extent to which wikis influence perceptions of fair and equitable teamwork.

Methods

The study is based on an assessment task which required students to work as a group of five to six members to construct a wiki in a unit dealing with personal and professional skills in business. There were 36 groups of students. The wiki task required each group to find and analyse 90 job advertisements across a range of business fields to determine the skills that employers are seeking. This information was then used as the foundation for a wiki which designed to inform readers about employability skills. Students were also advised that their final exam would contain a question about the content of the wikis, thereby creating an incentive for students to visit the wikis of other groups. Because the site was intended to be a summary, students were restricted to ten pages, but were encouraged to link to more detailed external information sources.

The wiki technology used by students was provided by a social software package called *TeamsLX*, which was embedded in the university's BlackBoard learning platform. *TeamsLX* allows instructors and students to collaboratively build shared knowledge bases within courses. The software uses a WYSIWYG interface and toolbars to support the creation of content. The *TeamsLX* software also identifies contributions at the individual level and tracks the evolution of a group's response, allowing teaching staff to assess each student's input to the group project.

A one hour briefing session was conducted early in the semester to orientate students to the wiki technology. The technical features of the wiki software were introduced to students, and the rationale for the assessment was explained. Groups worked on their wikis for about six weeks, during which time the wiki was not visible to other members of the class. Once the due date for the assessment had passed members of the class were able to see all group wikis constructed in the unit, but the wikis were not available to the general public.

The evaluation of the wiki assessment was conducted by asking students to complete a two page self-administered questionnaire distributed in class in the final week of the semester. Students were advised that participation was voluntary and to ensure anonymity no personal identifiers were recorded. The first page of the questionnaire included basic demographic questions and a set of five-point Likert scales to gauge student responses to the assessment. Some of the Likert items were adapted from an instrument used by Luca & McLaughlin (2005) to assess student perceptions of using blogs as a collaborative learning tool. Some items were also developed from the work of Forte & Bruckman (2006). On the second page students were asked to respond to three open ended questions. Students were asked to indicate what they liked most and what they liked least about the wiki assessment and how the wiki assessment could be improved.

The sample consisted of a mix of 86 first year business students. *Table 1* provides a profile of the respondents. There were a higher number of female students in the sample but female students are actually somewhat underrepresented as the proportion of female students in the subject was 67%. Most of the students were studying full-time and 94% were from the Generation Y cohort born 1977 to 1996 (Gorman, Nelson & Glassman, 2004).

Table 1 Socio-demographic profile of respondents

	Responses	Percentage
<i>Gender</i>		
Female	48	55.8%
Male	38	44.2%
<i>Age (n = 85; median = 19)</i>		
17 to 20	69	81.2%
21 to 25	10	11.8%
26 to 30	1	1.2%
Over 30	5	5.9%
<i>Characteristics</i>		
Non-English speaking background	16	18.6%
First in family to attend university	46	53.5%
Enrolled full-time	78	90.7%
<i>No. of hours spent on wiki task (n = 77; median = 14 hours)</i>		
5 hours or less	12	15.6%
6 to 10 hours	22	28.6%
11 to 15 hours	14	18.2%
16 to 20 hours	18	23.4%
More than 20 hours	11	14.3%

Results and Discussion

Table 2 provides a summary of student perceptions of the wiki assessment. The first aim of this study was to examine student views about the flexibility and ease of use provided by wikis. The results suggest that students were generally positive about both of these areas. Most students felt that the wiki assessment was better than a traditional paper-based team assignment (mean = 2.37) and the convenience aspect of the assessment was clearly well received (mean = 2.11). These findings were also reflected in some of the qualitative comments. Students used words and phrases such as convenient, easy to access, new and interesting, interactive, different and ‘new learning experience’ when asked what they liked most about the assessment. Several students also noted that the reduced need for face-to-face meetings was the most positive aspect of the task. One student noted that: “It was available for members to work on when the time suited them best” while another wrote: “I didn’t have to see my team members to start or do work on the wiki”. Students clearly liked the ability to work on the wiki from home.

Table 2 Student perceptions of the wiki assessment

	Respondents			Mean*
	Disagree	Neutral	Agree	
Enjoyment and Ease of Use				
The wiki was better than a paper-based team assignment / summary	18	10	54	2.37
The wiki tools were easy to use	17	19	45	2.53
I had no technology problems when using the wiki	23	23	35	2.68
I enjoyed using the wiki in this unit.	20	24	37	2.78
Flexibility				
The wiki allowed me to contribute to teamwork at a time and place that was convenient	6	19	55	2.11
The wiki reduced the need for face to face contact with my group	13	20	46	2.41
Collaboration				
I felt comfortable about editing the work of other team members	18	21	41	2.63
The wiki helped promote discussion with other team members about tasks required to finish the assessment.	17	28	37	2.72
Using the wiki helped the team develop a better product.	18	28	36	2.80
The wiki enhanced the level of meaningful intellectual exchange between group members and others in the class	17	37	26	2.90
Sharing				
I liked looking at the wiki's of other teams	17	35	27	2.86
Knowing that the wiki would be available to the rest of the class after the due date influenced the way I approached this assessment	38	22	20	3.35
Reflecting on progress				
The wiki allowed the me to identify and rectify content errors and problems made by other team members	8	22	49	2.34
The wiki is great for tracking tasks because it keeps all team members informed about progress.	9	26	46	2.43
The wiki made it easy to track and reflect on my progress	9	30	40	2.54
The wiki helped alert me to problems that others were having in my team.	12	37	33	2.65
Using the wiki assisted with my learning.	18	33	30	2.83
Fairness				
The weighting allocated for the wiki assessment was fair	9	30	40	2.54
I would like to see the wiki used like this in other subjects with teamwork.	17	31	33	2.77
Using the wiki helped promote fair and equitable teamwork.	19	28	35	2.80

* Mean based on 1 = Strongly Agree ... 5 = Strongly Disagree

Most students felt that the technology was easy to use, but some students struggled with the technical aspects. An assessment of the qualitative comments suggests that most of these frustrations were due to the speed of using the wiki and the limitations of some formatting features, which were described as ‘fiddly’. Some students felt that the lack of some features

impeded their capacity for creative expression but others appreciated the opportunity to use a variety of media. One student noted that she enjoyed playing with pictures and colours when she got sick of doing 'real work'. A few students were also frustrated that they were not able to edit a wiki page while another group member was working on it. This problem only affected a small number of students and was only encountered close to the due date when multiple group members were endeavouring to finish their wiki.

The second aim of this study was to assess the extent to which wikis encourage collaborative learning and reflection. The results in Table 2 suggest that some teams were more successful than others in using their wiki as a collaboration tool. Most students did not seem to be concerned about editing content contributed by other team members. In fact some students relished this opportunity. One student wrote: "I liked how my group members could work/expand on my ideas" while another indicated that the wiki was a "great way to put info together". However, many students appeared to be unsure about whether the wiki helped the team produce a better outcome, while about 21% of students felt the technology did not deliver this benefit at all. One student observed that he had spent a large amount of time contributing content, only to find that not much of it was used in the final submission. Another student wrote: "Group members could edit the work I did when I was satisfied with it but they changed it to their info." Furthermore, while some students felt that the wiki supported meaningful intellectual exchange (mean = 2.90) and promoted discussion (mean = 2.70), many were uncertain or disagreed that this was the case.

In the qualitative responses many students noted that not all group members contributed equally or that some team members left their contribution to the last minute. While this is a common frustration with other types of collaborative learning, the wiki assessment did allow academic staff to identify social loafers. Although the marking rubric for this assessment penalised social loafers, students were still frustrated by this behaviour. Clearly this type of behaviour limits opportunities to develop content in an organic and evolutionary manner. Several students suggested that a staged assessment of the wikis at various times during the semester might motivate some students to contribute earlier.

The capacity to use the wiki as a tool for reflecting on individual and team progress was evaluated more positively. Students clearly liked the ability to identify and correct content errors (mean = 2.34) but oddly fewer students agreed that the wiki alerted them to problems that other team members were having (mean = 2.65). Perhaps the first statement is related purely to content quality, while the second deals with broader challenges and problems that team members may have experienced (such as an inability to use or access the technology). When reflecting on their own learning, many students seemed uncertain about whether the wiki was beneficial. One student wrote: "I felt the wiki did not really teach me anything about the content" but another indicated that the best aspect was "the skills that were learned from doing this assessment, such as communication, technology and teamwork."

A third aim in this study was to evaluate the extent to which wikis support fair and equitable teamwork. Most students agreed that the weighting allocated to the assessment (20%) was appropriate. Many students were also keen to see wikis used in other units, implying that they generally considered this to be an acceptable form of group assessment. Only 19 students felt that the wiki did not promote fair and equitable teamwork.

To further explore some of the reasons for the range of responses, means tests were conducted between various groups of students. These tests explored differences between students according to gender, age, language background and the number of hours spent on the wiki task. Given the

non-parametric nature of the data the Mann-Whitney statistic was used. The results indicated that age was not associated with any significant differences in mean ratings; however the general pattern of results indicated that older students were more likely to disagree with most of the statements. There were some significant differences between male and female students. Females were significantly more likely to agree that the availability of the wiki to the rest of class influenced the way they approached the task. The female mean was 2.89 while the mean for males was 3.94 ($U = 379.5$; $p = 0.000$). Females were also significantly more likely to agree that they enjoyed viewing the wikis of other teams (mean = 2.66) than males (mean = 3.11; $U = 565.0$; $p = 0.032$). Both findings are connected with the notion that wiki assessments, unlike many other assessment tasks can be easily shared with others in a class. Females also tended to show a higher level of agreement with most of the statements. Given the small sample size it would be worth exploring these differences in future studies. In most instances, the ratings of NESB students did not differ a great deal with students from an English speaking background. However, NESB students were less likely to agree that they enjoyed looking at the wikis of other teams (NESB mean = 2.98; ESB mean = 2.33; $U = 305.5$; $p = 0.021$). However, given the small number of NESB students in the sample no sound conclusions can be drawn from this finding.

To explore whether the number of hours students spent on the wiki task had any impact on their ratings, students were divided into two groups: those who had spent less than the median number of hours (i.e. 14 hours) on the task and those who had spent more than the median. A comparison of these two groups reveals only one significant difference, with students below the median more likely to agree that the wiki reduced the need for face to face contact with their group (mean = 2.19) when compared with students above the median (mean = 2.71, $U = 418.5$; $p = 0.010$). The results did not indicate an overall pattern of responses but it was interesting to observe that students who had spent less time on the wiki task were less likely to agree that the wiki promoted fair and equitable teamwork. The same group was however more likely to agree that the weighting allocated for this assessment task was fair and equitable. While these differences were not significant they are worthy of further investigation.

Conclusion and Implications

This paper started with the assertion that industry requires professional graduates who are able to manage knowledge using the latest technological innovations. It is proposed that the use of ICTs in teaching and learning provides some opportunities to help graduates develop a range of knowledge management skills, including creative collaboration, consensus building and technical literacy. While not without problems, wikis do require students to gather, construct, modify and correct information. The nature of this technology also allows students to make their own connections between items of information. This study reinforces previous findings that wikis do support the development of some of these knowledge management skills. However, it appears that this is only true for some students. While the use of a wiki assessment was clearly enjoyed by many students, some students did not find the technology to be a particularly useful collaborative tool.

The assessment might be improved as a collaborative learning approach by reconceptualising it as a staged assessment in which individual contributions are evaluated at various points during the duration of the task. This might encourage some students to make a more sustained commitment to the wiki, thereby improving the prospect for collaboration. There is an opportunity for further research to examine why some students did not engage with the content or collaborate with team members in the virtual space. The reasons are likely to be complex and varied, but may include time constraints, lack of motivation, lack of technical expertise or even technophobia. Bruns &

Humphreys (2005) observed in their work that some students were uncomfortable with interfering with the work of others but this did not appear to be a concern for most students in this study.

From a social constructivist perspective, the wiki did encourage students to collectively construct a knowledge base of skills listed in job advertisements with very little input and guidance from academic staff. The wiki assessment was linked to the final exam, requiring students to look at the wikis of other groups when revising for their exam. This assessment structure encouraged students to look at some detail at the wikis of other groups and this aspect appeared to be reasonably well received. This supports the findings of Forte & Bruckman (2006) who found that a sense of audience played an important role in constructing meaningful content. In some wikis the collection of multimedia, text and external links was sophisticated and the wiki usage statistics indicated that the content had been assembled over a sustained period of time from the input of all team members. The structure and richness of the information composed by students would be difficult to duplicate using more traditional assessment pieces.

Perhaps the most striking aspect of the study was that the wiki assessment was very successful as a flexible learning task. Students readily acknowledged the convenience of being able to work on their wiki 'any time, any place'. As the socio-demographic characteristics of students in Australia continue to change it will become increasingly necessary for universities to provide learning experiences that allow students to balance work and study commitments. The challenge for educators is to ensure that these learning experiences are equivalent to, or better than more traditional face-to-face activities and tasks.

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