
# Leveraging technology for engaging learning design

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Web 2.0 tools alone do not teach or result in effective or meaningful learning. A review of literature on evolving learning designs based on the tenets of Pedagogy 2.0 (Lee & McLoughlin, 2010) highlights four contributing elements of design for socio-constructivist learning environments: authenticity, motivation, scaffolding and skills development. This paper details an innovative learning design for the integration of technology to provide flexible access and encourage engagement while facilitating the development of knowledge management skills in an undergraduate course. A combination of technologies and strategies were used to encourage students to sufficiently engage in the assessment tasks. These were: course website for information provision, WebQuest for scaffolded instructions, wiki for collaboration and social bookmarking for sharing and reviewing references. The evaluation of the learning design was generally positive with students reporting increased 'tech savvyness'. However, a significant challenge was facilitation of equitable and synergistic group work which is central to socio-constructivist learning designs. Future iterations of the design will focus on this aspect in addition to encouraging student engagement with the Web 2.0 tools that were underutilized this time.

Keywords: Web 2.0, Pedagogy 2.0, digital literacy, learning design, personal knowledge management, WebQuest

## Introduction

Technology integrated teaching is always a challenge, even more so when teaching first year courses. Assumptions are made about the digital literacy and technical skills possessed by students. The notion of them being 'digital natives' (Prensky, 2001), or the 'net generation' (Oblinger & Oblinger, 2005; Tapscott, 1998) assumes that they are skilled at using and adapting technologies for educational use. However, educational researchers are increasingly discovering that these 'digital natives' or the 'net generation' possess technical skills to utilize technology for social interactions and networking but not for educational gain (Cigognini, Pettenati & Edirisingha, 2010; Kennedy et al., 2007; Narayan & Baglow, 2010).

The current and potential use of social software in tertiary education has been well documented (Bates, 2010; Bower, Hedberg & Kuswara, 2009; March, 2007; Lee & McLoughlin, 2010). The literature predominantly describes a socio-constructivist perspective that promotes greater learner control of the learning environment, making learning in the Web 2.0 world more social and collaborative. In the socio-constructivist pedagogy, actively engaged students learn by sharing information through participation in collaborative and cooperative activities (Sthapornnanon, Sakulbumrungsil, Theeraroungchaisri & Watcharadamrongkun, 2009). Group work is a major strategy used to facilitate such sharing of information. It also enables co-construction of knowledge and understanding that capitalizes on the peer-peer interactions and productive elements of the dialogic and constructionist pedagogies as well (see Figure 1).

Web 2.0 tools alone do not teach or result in effective or meaningful learning. "[T]here must be particular purpose or rationale for their use, and teacher support and guidance…are still…essential" (Bates, 2010, p29). Contemporary educationalists agree that technological development in parallel with evolving pedagogies optimize the opportunities afforded by Web 2.0 (Bower et al., 2009). The evolving pedagogy, framed as Pedagogy 2.0 (Lee & McLoughlin, 2010) shifts focus from knowledge acquisition to knowledge transformation (creation and building) in authentic, motivating and well scaffolded learning environments that still maintain strong connections to curricula.

Pedagogy 2.0, while enabling "new pathways to learning with peers" (McLoughlin & Lee, 2010, p59), gives prominence to the "cultivation of digital competencies in ways that allow learners to develop their critical thinking, knowledge building and creative skills" (p60). Consistent with this is the increased emphasis being placed on embedding academic literacies (including digital and information literacy) into the curriculum (Gunn, Herne & Sibthorpe, 2010) to enable learners to take full advantage of Web 2.0 technologies by developing their skills and abilities to search, retrieve, analyse, evaluate, organize, create and share information (Bates, 2010; Cigognini et al., 2010; McLoughlin & Lee, 2010).

According to Lee and McLoughlin (2010), teaching and learning with tools that are otherwise used in social contexts requires teachers to "demonstrate its relevance and to adopt innovative approaches that take advantage of the unique capabilities and affordances of these tools". Alam & McLoughlin (2010) go as far as saying that as educators it is our "moral and ethical obligation to … maintain a participatory and inclusive attitude in pedagogy and in learning environment design." This re-affirms our belief that the success of technology integrated teaching does not solely depend on the affordances of technology but more so, on the influences of the target audience's ability to access, review, use, and manage information. How do we make the best possible use of Web 2.0 technologies to meet our needs and student demands for technology integration while taking into consideration their varying levels of skills (Ryberg, Dirckinck-Holmfeld & Jones, 2010) and digital literacy?

## Focus

Web based technologies such as podcasts, online lectures, online discussions, and more recently Web 2.0 applications are increasingly being used by schools of pharmacy to provide effective learning opportunities for pharmacy students (DiVall, 2008; Estus, 2010; Miller, 2009; Swu-Jane, 2007; Sthapornnanon et al., 2009).This paper details an innovative learning design for the integration of technology to provide flexible access and encourage engagement while facilitating the development of knowledge management skills in a group assignment of an introductory pharmacy course.

## Definitions

For the purposes of this paper:

- Web 2.0 applications are social software that allow multiple users to collaborate via sophisticated, interactive interfaces to develop micro content that is usually openly available (Alexander, 2006 cited in Bower et. al, 2009).
- Pedagogy 2.0 is the "conceptualization of teaching that is focused on participation in communities and networks for learning, personalization of learning tasks and production of ideas and knowledge" (McLoughlin & Lee, 2010, p 68).
- Scaffolding is the conceptual framework for learning support that enables students to perform better than they would otherwise do in the absence of any type of support (Cho & Jonassen, 2002 cited in March, 2007; McLoughlin, 2002).

## The context

The School of Pharmacy at The University of Auckland recruits students from throughout New Zealand. Many students leave Auckland during university breaks, whilst others have work or family commitments to contend with. This year, the 99 students enrolled in P101: Pharmacy Practice I had five weeks to complete the group assignment. Two of these weeks fell in the university break and two were where some students had a heavy academic workload. Therefore, the assignment was re-designed to incorporate an appropriate blend of technologies that allowed students to access and complete this assignment flexibly and removed the need for them to meet face to face with other group members or to visit the campus library in person to search for information. The components of the assignment and respective assessment details are presented and described in the Table 1.

Table 1: Components of P101 assignment

| Component and format | Requirements | Assessment details |
|---|---|---|
| e-poster (developed using Microsoft PowerPoint template based on an exemplar provided). | Students were randomly assigned into groups and asked to collaboratively design an e-poster on a given topic. In this case, the topic was the social implications of a chronic disease. | Group mark.<br>The assessment rubric covering content, references and overall design was available to every group member. |
| Oral presentation of the e-poster (free use of props and different presentation tools). | Students, in their respective groups, present their e-poster to the class. | Group mark.<br>The focus of the assessment was on the depth and breadth of research reflected by the quality of the presentation and the group's ability to answer questions from the class. |
| One page written summary of work (print out). | A referenced summary of the e-poster, representing the group's findings is handed in at the oral presentation session. | Group mark.<br>The focus was on properly crediting and referencing all the literature used in the e-poster. |
| Three web references with justification for their usefulness (shared electronically). | Individual students are required to share three web references that they found useful in retrieving information for the e-poster. They are encouraged not to duplicate website references already shared by their classmates. | Individual mark.<br>Marks were allocated based on the quality (judged by the criteria discussed in the lecture) of the websites submitted. |

## Design of an integrated assignment

### Learning design considerations

A review of literature on evolving learning designs based on the tenets of Pedagogy 2.0 (Lee & McLoughlin, 2010) highlights four contributing elements of design for socio-constructivist learning environments: authenticity (Alam & McLoughlin, 2010; Cigognini et al., 2010) , motivation (March, 2007), scaffolding (Bates, 2010; Brack & Van Damme, 2010; Collis, 1998; March, 2007; Ryberg et al., 2010; Sthapornnanon et al., 2009) and skills development (Alam & McLoughlin, 2010; Bower et al, 2009; Cigognini et al., 2010; Gunn et al., 2010). It is important to note that all these elements were identified and taken into consideration for our specific learning design as P101 is an introductory course where, for most students, this was the first time they had experienced the educational use of Web 2.0 in their degree programme. Hence, capitalizing on the evidence base, the use of Web 2.0 tools was authentic, purpose driven, well scaffolded and linked to assessment while attempting to develop students' digital literacy and knowledge management skills for life-long learning opportunities.

The aims of the learning design were:

23. To provide flexible access to resources and tools to enable students to complete individual and group components of the assignment off campus.
24. To enable the teacher to monitor student collaborations in group tasks and manage assessment better.
25. To enable students to develop personal knowledge management (PKM) skills in Web 2.0 that they can use in the Bachelor of Pharmacy programme and beyond.

Figure 1 visualizes the learning design concept, which was a combination of approaches suggested by Bower et

al. (2009), Dave (2009), McLoughlin & Lee (2010), McLoughlin (2002) and represented in an adaptation of the PKM skills model (Cigognini et al., 2010). Core to our learning design was the idea that 'technology is a mediator of pedagogy and content' (Alexander, 2006 cited in Bower et al., 2009). The types of thinking and processes that students needed to engage in to complete their course requirements was paramount in identifying the appropriate blend of technologies. The position of technology in the periphery of the design is testament to the fact that technology does not drive learning but it does have affordances that can be built on to provide better learning experiences. In addition to this, technologies are rapidly changing hence the broken line. Knowledge and skills are at the core of the learning design. In this case, technology enabled us to provide flexible access to the course content ensuring equity in access and facilitated the development of digital literacy, group culture and PKM skills. The latter was possible through linkages to the course assessment that provided some degree of motivation for students to engage sufficiently.

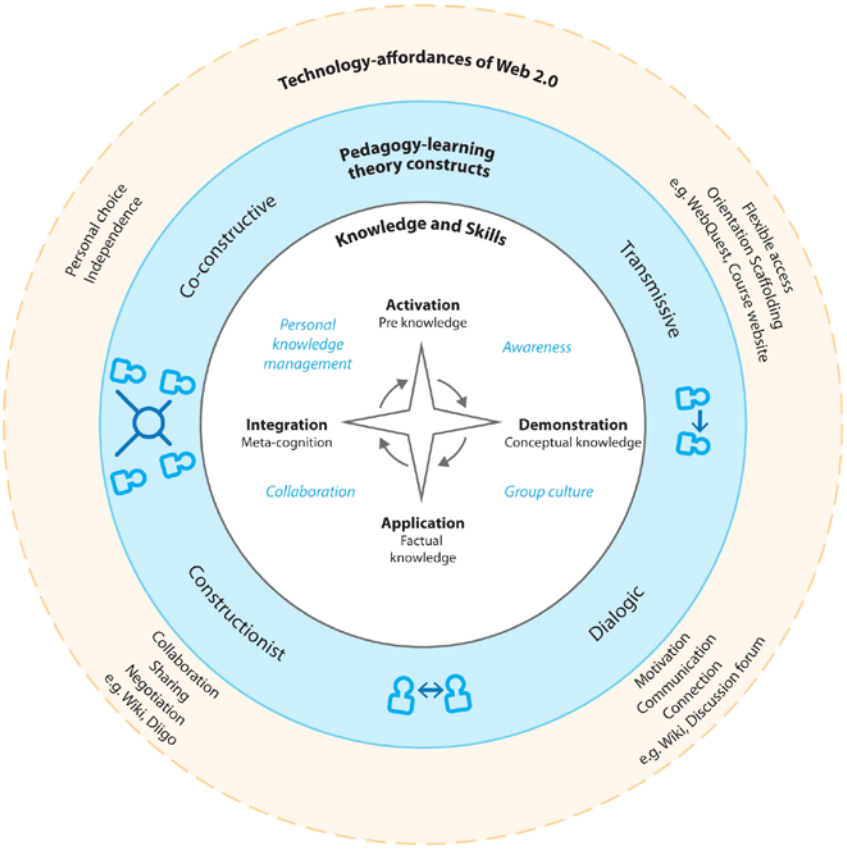


**Figure 1: Learning design of P101 integrated assignment**

*Affordances of Web 2.0*

As defined previously, Web 2.0 refers to social software. The myriad of Web 2.0 applications available (see http://www.go2web20.net/) add to the complexity of matching the affordances of each with its usefulness in education. Common applications that have been widely used in educational contexts are blogs, wikis, social bookmarking and social networking. Meaningful use of these tools can vary from mere provision of information (flexible access, orientation) and guiding learning processes (scaffolding) to encouraging motivation, enabling connections and PKM. The particular function is largely dependent on the context in which these tools are used. It is suggested that a 'suite of tools' is better than a particular technology in learning designs to ensure learners have a choice to "engage in meaningful tasks" (Alam & McLoughlin, 2010). The type of tasks and thinking processes students engage in are far more important than the type of technology (Alexander, 2006 cited in Bower et al., 2010). With due consideration to this, we used a number of tools in our learning design as described in Figure 1.

*Pedagogy for Web 2.0 learning design*

Ways of interacting to engage in knowledge building processes is an important element of online pedagogy (Bower et al., 2009). Web 2.0 learning designs are usually situated in the socio-constructivist approach. However, as educators document their Web 2.0 learning designs, it is becoming obvious that there still is a place for transmissive, dialogic and constructionist approaches. Many students need the 'structure and guidance' (Bates, 2010) that can be offered via the transmissive approach. A particular example from our learning design

is the provision of information on the course website including detailed descriptions of each tool and 'how to' guides. Though transmission is considered a low order thinking process, it is still relevant in 'cognitive apprenticeship' (Collins, Brown & Holum, 1991, cited in Bower et al., 2009) where the expert imparts knowledge and models thought processes.

Dialogic and constructionist approaches are centered on discourse between peers in a learning environment that encourages and motivates students to engage in meaningful dialogue; a core requisite for collaborative learning. These can be built on to produce a co-constructive pedagogy where learners are expected to engage in higher order thinking processes and develop the ability to manage information and take control of their learning while sufficiently engaging in collaborative group work. Our learning design, as it was for beginner skills and content, did not aim to proceed to the highest level of PKM.

*Knowledge and skills*
As mentioned before, Web 2.0 learning designs have increased focus on developing skills such as knowledge management and information literacy to enable learners to take full advantage of these learning environments (Cigognini et al., 2010). According to Cigognini et al. (2010), PKM is a 'multifaceted set of abilities and processes' that an individual undertakes to gain and share knowledge. This hinges on 'digital competency' when the learning environment is Web 2.0 based. Since our design was for an introductory course, every attempt was made to facilitate the development of PKM skills. The development of such skills takes time, however, the process begins in a close structured environment such as that provided in the design of the P101 technology integrated assignment tasks.

## Selection of technologies-finding an appropriate blend

*Information and structure through the course website*
The course website was designed and developed using an in house interactive web development tool called CourseBuilder (http://www.cad.auckland.ac.nz/index.php?p=coursebuilder). It complements the features and capabilities of the Learning Management System, therefore enabling us to make optimal use of both systems. The website provided all the information required to complete the assignment e.g. timetable, deadlines, group allocations and extensive stepwise instructions on how to use the e-tools provided.

*Scaffolded inquiry through a WebQuest*
The assignment itself was presented as a WebQuest (Dodge, 1997) which contained detailed information to allow successful completion of the assignment. The WebQuest strategy was proposed by Berni Dodge and Tom March in 1995 to develop engaging web-based tasks that elicit higher order thinking through guided inquiry (Starr, 2005). Rather than force-fit an earlier approach, we adapted the revised version of WebQuest that "highlights its benefit to both students and teachers as a framework for leveraging achievement and maximizing authentic learning" in a Web 2.0 world (March, 2007).

In order to create an authentic experience that was contextualized, students, in their randomly assigned groups, were allocated a chronic disease and asked to produce a promotional e-poster for a fictional charity trying to elicit donations from the public. All information presented had to be sourced from the internet and general criteria were set about the scope and format of the e-poster (see Table 1). E-posters were accompanied by an oral presentation to peers, and at the end of the assignment, students voted for the groups that they felt elicited in them a desire to make a monetary donation. Tasks included listening to a recorded lecture, accessing and extracting information from websites providing guidance on team work, and voluntary tasks and quizzes related to searching, retrieving, and appraising medical and health information sourced from the internet. Some educators perceive the inherent structure of the WebQuest to be limiting (Barbour, Rieber, Thomas & Rauscher, 2009) but as indicated by Bates (2010), we wanted to provide a structure and sufficient guidance to motivate students to engage in the learning process. 'Transformation scaffolds' form the core of every WebQuest and can encourage student motivation and facilitate advanced thinking with appropriate integration of enriched learning resources (March, 2007). According to March (2007), technology can provide its 'disintermediating effect' that can help learners prime their own intrinsic motivation.

*Collaborative learning through a group wiki*
A wiki (PbWiki) was provided for each of the groups, which consisted of four or five randomly allocated students. The use of wikis in socio-constructivist environments involving group work is well documented (Cain & Fox, 2009; Collis, 1998; Miller, Bookstaver & Norris, 2009; Collins, Huber & Groom, 2010; Brack & Van Damme, 2010; Bower et al., 2009) and according to Dabbagh & Reo (2010, p14) wikis "epitomize the social constructivist idea that knowledge derives from social interactions, since it is a social software tool that makes it easy for multiple users to create and edit web pages collaboratively."

The wiki enabled flexible access and multiple options for group collaboration. Though we set up wikis for every group and encouraged them to use this collaborative tool, the onus was on the groups to put this into effective practice as no marks were allocated for using the wiki. The usefulness of such a collaborative technology is dependent on many variables (see results and discussion).

*Networking, knowledge construction and sharing through social bookmarking*
A social bookmarking site (Diigo) was used for students to submit individual contributions to a shared bank of web resources. The networking nature of this tool enabled students to share their web references and provide feedback on other students' submissions. A requirement of this task was to avoid duplication of references already submitted by other students on the network. This added an element of competition, intended to motivate students to realize the full potential of social bookmarking which according to Bower et al. (2009), can range from the promotion of recall, identification and exchange of factual information to facilitating discourse.

## Student perception of learning design for technology integration

All students in this cohort successfully completed the assignment. However, in order to evaluate the learning design for technology integration from the students' perspective, their opinions of the assignment were sought via an anonymous online survey and a focus group facilitated by the lead author. The online survey was adapted from the one published by Burchum et al. (2007). It consisted predominantly of questions presented in a 5 point Likert scale format but also included questions requiring ranking and free text responses. The focus group was intended to gather more considered and detailed opinions on the process of completing the assignment and the perceived usefulness of the technology integration into the assignment. Participation in both activities was voluntary and in order to facilitate the candid opinions of the participating students, the identities of those who participated in the focus group were kept confidential and not revealed to the School of Pharmacy staff member involved in this project.

### Results and discussion

*Online survey*
Fifty four students out of 99 completed the survey; therefore, a response rate of 54.5% was achieved. An encouraging 67% of the responding students enjoyed the assignment. Table 2 provides a summary of the responses in relation to specific strategies and tools used.

**Table 2: Summary of evaluation**

| Strategies and tools | Students' perception |
|---|---|
| Scaffolded inquiry into an authentic task - WebQuest | 77.8% agreed that the WebQuest added value to the assignment.<br>87% thought the WebQuest tasks assisted them in learning to distinguish between reputable/authoritative websites from other less reliable ones.<br>51.9% agreed that the WebQuest contained enough information to complete the assignment without any further instructions from the teacher. |
| Collaborative learning - wiki (PbWiki) | Wiki was ranked the most useful and enjoyable and 68.5% would be confident to use them in future assignments. However, 44.4% of students were unsure if the wiki promoted effective student-student collaboration. |
| Networking, knowledge construction and sharing – social bookmarking (Diigo) | Diigo was voted the least enjoyable but the second most useful of the tools.<br>48.1% do not intend to keep using and adding to the social bookmarks created during the assignment while 42.6% were undecided. |
| Knowledge and skills development (digital literacy measured as 'tech savvyness', group work, knowledge management) – use of various etools in assessed tasks | 51.9% agreed that the assignment tasks helped them develop transferable technical skills. Figure 2 illustrates the change in 'tech savvyness' before and after completion of the assignment.<br>75% of students thought that the assignment developed their ability to work effectively in a team and 63.5% thought that their team worked well together. However, free text reponses indicate that managing the group work was also a challenging aspect of the assignment for some students. |

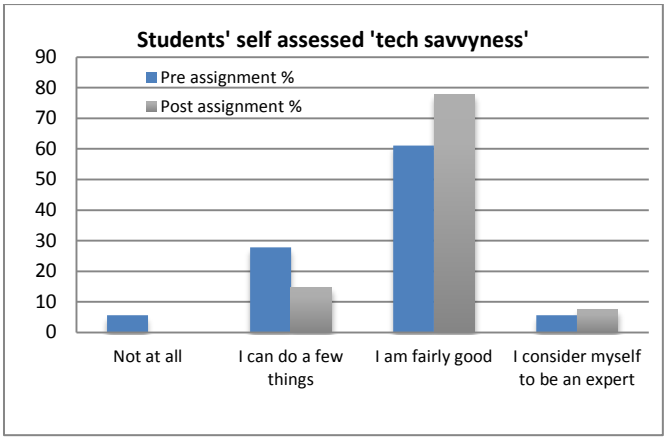


**Figure 2: Self assessed student 'tech savvyness'**

*Focus groups and open ended responses*

Focus group responses re-affirmed the findings of the online survey. The assignment as a whole was well received but some students expressed dissatisfaction with aspects of the group work involved. As many groups failed to negotiate roles and get the work done equitably some students thought that it was unfair to award marks predominantly based on group produced work. This is consistent with what Brack & Van Damme (2010) reported as group progression from collaborative to cooperative over the course of the group task.

Motivation was also another important factor with most students complaining about the lack of commitment shown by some group members. The idea of introducing a reward system for those taking the initiative was also suggested so individuals are held accountable for their part in the group task. Two student quotes given below illustrate contrasting views on group work.

> "group work sucks. I ended up doing heaps of ours while others did very little. It just doesn't seem fair. And i know that the idea is to work together, BUT if your members are not responding to email after email after email, then what else are you suppose to do? Fail or do it all. It puts studious students under too much stress and gives slackers a free ride." (P101 student)

> "…thank you for giving us the opportunity to know our team members better! I felt that this assignment was a great way to promote team-bonding!" (P101 student)

It was also clear from student comments in the evaluation that though majority of the assessment tasks required them to collaborate in groups, their individual experiences were quite varied. The perceived usefulness and the extent of use of the Web 2.0 tools were dependent to some degree on students' digital literacy and technical skills. Though attempts were made to facilitate the development of such skills to influence the extent of use, not all the tools were utilized to their maximum potential. The difference in 'tech savvyness' (see Figure 2) is evidenced in the following comments:

> "We only had to use basic programmes for this assignment so I did not really learn anything too extravagantly new." (P101 student)

> "I would definitely use Diigo now as a good bookmarking source rather than adding a whole bunch of websites to my Favourites tab on my browser…" (P101 student)

## Contributing elements of design for socio-constructivist learning environments revisited

*Authentic learning*

The use of a WebQuest enabled students to engage in an authentic learning experience that Cigognini et al. (2010) advocate is the basis for developing digital literacy and knowledge management skills. The graduate profile for the Auckland School of Pharmacy includes the ability to be able to communicate effectively in writing and orally, apply critical thinking and structured problem solving techniques, and utilise technology effectively to acquire, organise and present health-related information. In addition BPharm graduates are expected to be able to work both independently and in teams, both as a leader and a member. Successful

completion of the WebQuest to develop the e-poster provided the opportunity for students to develop, apply and demonstrate aspects of all these skills. Boud et al (1999) suggested that students articulating their emerging understanding of an area can deepen their own grasp of the subject. The oral presentations associated with this assignment involved peer teaching and were well received by students, indeed some students suggested making the oral presentations longer to enable them to fully articulate what they had learnt.

*Motivation*
Collis (1998), Alam & McLoughlin (2010) and Brack & Van Damme (2010) all mention aspects of motivation as influencing the success of group tasks using collaborative tools like wikis. In P101, wikis were provided as a tool to help students collaborate and complete their assignment flexibly but the use of the collaborative wiki was not compulsory. Student satisfaction with using this tool depended on their experience of group work. Frustration arose due to the asynchronous nature of the wiki because motivated team members found that it was difficult to communicate with and manage the contributions of less motivated group members. Though the task was designed to be 'motivating in itself' as Collis (1998) suggested, sufficient engagement from students depended on how their groups utilized the wiki as the onus was on them to be active in the inquiry process (Alam & McLoughlin, 2010).

Facebook groups were set up spontaneously by several student groups, and texting and e-mail was also used as an alternative to the wikis. Students found the use of these methods more effective than the wiki for communication, coordination and management of data collection and assimilation tasks required to create the e-poster. However these alternative methods of completing the assignment did not allow the teacher to monitor individual contributions and group progress in this instance.

*Scaffolding*
This concept is widely publicized in all aspects of Web 2.0 use in educational contexts as a result of researchers questioning the assumption that 'digital natives' possess sufficient digital skills to learn effectively in technology integrated environments. Sufficient scaffolding through strong links to curricula is suggested by Ryberg et al. (2010) for young people who might not come to university equipped with digital literacies. As indicated in Table 2, the majority of students found the WebQuest activity to be valuable for their completion of the assignment. This aspect of the assignment was also the most structured with scaffolding being the very justification of its existence (March, 2007).

McLoughlin (2002) presents various categories of scaffolds, of which, orientation (communication of expectations), coaching (learner support via software help), task support, expert regulation (sharing exemplars), conceptual and procedural scaffolding were all implemented in various ways in this integrated assignment. However feedback from the student evaluation indicated that the assignment instructions concentrated predominantly on the e-tools and knowledge required to complete the assignment, which improved the equitable nature of the assignment but neglected to equally scaffold the team work aspects of the assignment. To improve this aspect of the assignment the next iteration of the learning design will incorporate the soft and hard scaffolds of face to face orientation and instructions for group work respectively (Brack & Van Damme, 2010). We intend to cover aspects of team work including roles, work allocation and communication strategies in a workshop and introduce a team building exercise at the start of the assignment. A requirement for group and individual progress reports will also promote accountability and encourage participation of all group members. This will also allow the teacher to monitor and manage any issues that occur and also allow individual student marks to accurately reflect their contribution to the assignment.

*Skills development*
Perhaps the best indication of students' developing knowledge management skills was the use of the social bookmarking tool (Diigo). The individual task involving Diigo, was worth a small percentage of the marks available for this assignment, and was completed by almost all of the class (98%). However evaluation of the assignment revealed that whilst some students used the class Diigo resource bank extensively to find material for their poster slides, some students did not realise the full potential of social bookmarking and used Diigo only to upload their websites to be eligible for their marks, without participating in and benefitting from the social aspect of this tool. In the next iteration of the assignment more time will be spent encouraging students to use this tool to its full potential by explaining the benefits of using this tool both for the assignment and throughout their degree programme and professional lives. Penalties for posting a web page already submitted will also be imposed. This will require a greater degree of engagement on the part of the student and may change their current perception that clearly indicates superficial level of engagement.

"Social bookmarking was done only because it was compulsory. It could have helped me if I was

> trying to collect as much information as possible but my aim was to complete the assignment, and therefore researched only information I needed…" (P101 student)

As mentioned before, PKM skills take time to develop and it may be that students need more exposure to the use of social bookmarking to fully appreciate its relevance and usefulness.

### Design plans for future iteration

In addition to what has already been mentioned, the next iteration of the course will focus on facilitating effective group work and promoting student engagement with the aspects of Web 2.0 tools that were underutilized this time. Perhaps a social networking tool such as Facebook may be used for collaborative work based on its communication features. As reported by Dabbagh & Reo (2010), there are three levels of social software use: level 1 is personal information management, level 2 is basic interaction and sharing and level 3 is social networking. The use of wikis and social bookmarking by P101 students in this assignment did not progress to the highest level of networking, as envisaged in the learning design but this might improve with the use of an actual social-networking tool for the purpose of collaboration.

Estus (2010) demonstrated the positive impact of using Facebook in an academic context with American pharmacy students. Creating private Facebook groups which all groups are required to use would enable the group work aspect of this assignment to be monitored and is an avenue that we intend to explore in future. We believe that the minimal use of the tools may have been because of the students' lack of appreciation of the potential and possibilities around knowledge management enabled by these tools, in particular, collaborative learning.

## Conclusion

This paper details an innovative learning design for the integration of technology to achieve flexibility in access and encourage engagement while facilitating the development of knowledge management skills in an introductory pharmacy course assignment. The results of the evaluation of the first iteration of the design are encouraging. All students successfully completed the assignment and some did develop skills as evidenced by the change in 'tech savvyness'. However, the intentions of the design did not fully eventuate in student actions for active development of PKM skills. The lessons learnt from the first iteration will be used to inform the learning design of future iterations.

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