An experience report on using collaboration technologies for distance and on-campus learning*

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Abstract
This paper summarises our experiences and observations using two online collaboration technologies, Blackboard and Wimba Live Classroom, while teaching Software Engineering courses. Blackboard is used to make announcements and course materials available. The Wiki facility of Blackboard is used to update information about software tools used in the course. In addition to the text chat and record feature in Blackboard, Wimba Live Classroom is used for audio chatting with application sharing and the whiteboard facility, and also to record lectures. Blended learning, which combines traditional face-to-face teaching with online methods, can improve the quality, convenience and flexibility of communication for participants and student satisfaction. This paper reports our experiences using Blackboard and Wimba in a blended-learning environment and presents our suggestions for using collaboration technologies in teaching.

Keywords: Software Engineering Education, Blended Learning, Collaboration Technology.

1 Introduction
The motivation for using online collaboration in teaching is to:
• improve the quality and convenience of communication for participants who are not collocated,
• share experiences between the different cohorts of students, and
• achieve economies of scale.

The challenge is to use the technology to enhance the educational experience without overwhelming either the teacher or the students.

This paper reports our experiences using online collaboration systems with distance learning in the context of the Master of Engineering (Software Engineering) at the University of Queensland (UQ). The paper evaluates our use of online collaboration systems within this program and identifies some ways to use online collaboration to the benefit of the program’s participants (both teachers and students).

Education is enhanced by communication, and compared to face-to-face teaching, distance education typically reduces the amount and quality of communication between teacher and learners, and between the learners themselves. By improving the quality and convenience of communication, we expect that student satisfaction will improve, which in turn is likely to lead to better student outcomes and increased student success. Attrition in distance education is a well-known problem that is expected to be reduced by improving the flexibility and quality of communication. Benefits of our approach combining distance education and collaboration technologies include:
• Synchronous bi-directional text/audio that works even on dial-up internet connections, or using traditional phone systems (for audio).
• An interactive whiteboard supporting drawing and highlighting.
• Ability to share programs executing on any participant’s desktop.
• Break-out “rooms” to enable small group work.
• Video quality that is adjustable to available bandwidth.
• On-the-fly survey and quiz development.
• Ability to record sessions for later playback.

Two different collaboration technologies, Blackboard (Blackboard 2009) and Wimba Live Classroom (Wimba 2009) were used in one of the Software Engineering courses offered at UQ. Blended learning (Graham 2005), which combines traditional face-to-face teaching with online methods, should improve communication between instructor and students (Schwartzman and Tuttle 2002), and students’ learning experiences (Cameron 2003, Riffell and Sibley 2003, and Schweizer et al. 2003).

The structure of the rest of this paper is as follows. Section 2 summarises the background to our work, and the collaboration technologies used and their features. Section 3 reports our experiences and observations using these collaboration technologies and provides suggestions for using these technologies in teaching. It also discusses our evaluation results. Section 4 reviews related work and Section 5 summarises our work.

2 Background
2.1 Context
The University of Queensland has entered into a partnership with Carnegie Mellon University (CMU) to
offer courses from their Master of Engineering (Software Engineering) through distance learning, enabling industry professionals to complete the program off-campus. CMU’s Models of Software Systems course (Models) was offered for the first time at UQ in Semester 1, 2008. A version of the course is available to post-graduate students enrolled in either the Master of Engineering or the Master of Science programs. The course is also available to honours students in the Bachelor of Information Technology and final-year Bachelor of Engineering students. Both courses are available to on-campus (internal) students and the post-graduate course is also available to external students. In 2008, the course attracted 17 students: 15 internal and 2 external.

The course covers a number of formalisms (e.g. Logic, FSP, Z, State machines, and UML) for modelling software systems and reasoning about those models. These formalisms are discussed and explored, so that students can choose an appropriate formalism for a particular system and context, model the system, and demonstrate that the model satisfies certain properties.

Several software tools are used in the course to create and check models. For example, Latex is used for preparing homework assignments. LTSA is used to write and analyse FSP models. CZT and Fuzz are used to write and analyse Z models. We used the application-sharing feature of Wimba Live Classroom to demonstrate some of these software tools during live chat sessions. Assessment in the course includes 13 weekly homework assignments, three small group projects, and the final exam.

Courses at UQ are taught over 13 weeks followed by a one-week study period and a two-week exam period. Unlike most other courses offered at UQ, the Models course has no scheduled lectures. Instead, recordings of lectures conducted by faculty and staff from the School of Computer Science at CMU are distributed on DVD. The primary live teaching activities are tutorial sessions. For internal students, the class is scheduled to meet for one two-hour session per week. This session is mainly used in "tutorial-mode" to deal with feedback and issues related to the homework assignments that have been completed by the students in the previous week as well as any other issues raised by the students (for example, questions about the tools, the next homework assignment, the group projects, etc.). For external students, the course is scheduled to meet in two one-hour chat sessions per week. Any significant issues raised during the tutorials with the internal students are discussed during the chat sessions, as well as any specific issues raised by the external students.

### 2.2 Collaboration technologies used

Two different collaboration technologies were used for teaching and learning activities. Table 1 shows the collaboration technologies and their use in different learning modes.

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**Table 1: Collaboration technologies used**

Blackboard was used to make course materials and announcements available (see Figure 1). The Wiki facility of Blackboard was used for software tools used in the course (see Figure 2). Initially, the chat sessions were run using the chat facility of Blackboard (see Figure 3), but when Wimba Live Classroom (Wimba) became available in the second half of the semester, it was used instead because of the advantage of live audio, as well as text chat and whiteboard facilities. We also used Wimba to record a guest lecture and a special presentation by the course instructor (see Figure 4).

### 3 Experiences and Observations

Table 2 summarises our experiences using the two collaboration technologies. Blackboard provides a framework to update course materials, announcements, and Wiki pages. We found that Wiki pages are effective for updating information about software tools used in the course (see Figure 2). Recording lectures with video using Wimba provides great flexibility and convenience for students to catch up with sessions that they have missed, or to review and strengthen their comprehension of the course content (see Figure 4).

Recently some courses offered at UQ have been using Lectopia (Lectopia 2009) to record lectures for later playback. Lectopia records audio and screen capture of the in-room data projector. This can be used with a computer, a visualiser or the centralised video replay centre. In contrast, Wimba Live classroom provides an interactive virtual classroom environment with features such as video of the presenter or of a student, audio, application sharing, whiteboard and content display.

Live chat sessions enable communication for participants who are not collocated. Students can ask questions on homework assignments and receive feedback on their own work via the chat sessions as if they were meeting face-to-face. Instructors can ensure students’ understanding by asking for immediate feedback, answering their questions, and giving in-depth verbal explanations of complex materials (with audio chatting). Students also communicate with their co-learners as if they were in the same classroom. These chat sessions can be recorded for replay by students who were not available for the live chat, or by students wishing to review the discussion.
Figure 1: Blackboard screen example

Figure 2: Blackboard wiki screen example
Figure 3: Blackboard text chatting example

Figure 4: Wimba lecture recording example
Collaboration Technologies | Positive | Negative
---|---|---
Blackboard | • Easy to review and search text chat recordings | • User interface is cumbersome for advanced users
 | • Text chatting allows simultaneous questions and parallel discussion threads | • Drawing diagrams or writing mathematical expressions on the whiteboard is difficult
 | | • The whiteboard is only recorded via the "Snapshot" feature |
Wimba | • Application sharing is effective | • Searching recordings of audio chats is difficult
 | • Audio chat sessions are more effective than text chat sessions | • Wimba and Internet connection required to replay lectures and chats (the audio can be transformed to podcast format)
 | • Whiteboard content is captured dynamically and automatically | • Drawing diagrams or writing mathematical expressions on the whiteboard is difficult

Table 2: Positives and negatives

3.1 Text vs. Audio chatting

During the semester, data was collected and analysed for students’ participation in the tutorials and chat sessions. Based on our experiences and the data collected from the chat sessions, we compare the chatting facilities of the two collaboration technologies.

We found that it is easy to review and search recordings of text chats using Blackboard. Text chatting also allows simultaneous questions and parallel discussion threads. However, the user interface of the text chatting facility of Blackboard was cumbersome for advanced users, and its whiteboard was only recorded via a “Snapshot” feature that has to be invoked manually.

By comparison, we found that audio chatting with Wimba classroom is more effective for communication. It also has a text chatting facility. Collected data shows that the average duration of audio chat sessions was much shorter than that of text chat sessions (65 mins for text chat sessions and 31 mins for audio chat sessions). Also fewer questions were asked during the audio chat sessions with the same number of students participating on similar topics. The ability to give in-depth verbal explanations of complex materials with advanced features such as application sharing and dynamic capture of whiteboard content is another positive aspect of the audio chatting. However, recorded audio sessions are difficult to search, and students need Wimba and an Internet connection to replay lectures and chat sessions, although it is possible to transform the audio of Wimba’s recorded sessions into podcast format.

It is difficult to draw diagrams or to write mathematical expressions on the whiteboard for both collaboration tools (see Figure 5).

3.2 Evaluations

Since the opportunity to compare Blackboard and Wimba only became possible during the running of the 2008 offering of this course, we had not systematically planned a before-and-after evaluation. Instead we chose to focus on student perceptions of the approaches. A survey on the collaboration technologies and software tools used in the course was conducted at the end of the semester. An online questionnaire was prepared covering three themes, such as enabling collaboration/interaction, course learning objectives and working with the technology using the Participant Perception Indicator (PPI) evaluation method (University of Michigan 2009). Twelve of the seventeen enrolled students responded anonymously by rating their responses on a scale of 1 (Low) to 5 (High) for each question.

The survey on communication and collaboration technologies showed that students:

- have a high-level of knowledge, experience and confidence in communicating with the instructor during tutorial sessions including live chat sessions,
- are confident about using the collaboration technologies to support their learning, and
- rely largely on the technologies that have enabled collaboration and interaction.

In addition to the PPI questionnaire, the course was evaluated via the standard UQ TEVAL (Teaching Evaluation) questionnaire administered anonymously to the students in the last week of lectures (or via mail for the external students). The survey on the course and teaching also reveals that student satisfaction is high and the collaboration technologies helped the students to achieve their goals from the course. The rating in response to the summary question “All things considered, how would you rate this staff member’s effectiveness as a university teacher?” was 4.64 on a 5-point scale. Written comments on the questionnaires were generally positive, but a few students commented on the heavy workload and one commented that the marking was too strict. Because our evaluations were both anonymous and the number of external students so few (2), it was not possible to investigate differences in performance or perception between on-campus and external students.

3.3 Suggestions

Our suggestions for using these collaboration technologies are:

1. Allow time to resolve technical issues with using Internet connections and the collaboration technologies prior to their use.
2. Audio chatting is effective for a single discussion thread, but text chatting is easier for tracking or controlling parallel discussion threads.
3. Recorded text chats are easier to review or search than recorded audio chat sessions.
4. Application sharing with Wimba is effective, but requires some practice.
5. It is difficult to draw diagrams or write mathematical expressions on an electronic whiteboard without a graphics tablet.
6. Video is a nice feature but not essential, and can cause bandwidth problems.
7. Avoid using wireless connections unless they are known to be reliable.
4 Related work

There is a growing body of research in the areas of distance learning and blended learning with online technologies. Wrubel et al. (2009) provide a research foundation for a virtual classroom environment. They discuss different dimensions of teaching models (e.g. asynchronous, synchronous, virtual and physical) and how e-Learning can affect student learning.


It has been pointed out that a major limitation of distance learning technologies is lack of interactivity (Jonassen et al. 1995 and Sherry 1996). Distance learning will be more effective when it takes place in stimulating learning environments designed to engage students (Jonassen et al.1995).

Belanger and Jordan (2000) introduce six distance-learning technologies (computer-based training, videotape, computer-aided instruction, web-based training, teleconferencing, and video tele-training), and discuss the advantages and disadvantages of each technology for learners, instructors, and institutions.

Jonassen et al. (1995) suggest that computer-mediated communication (especially computer conferencing), computer-supported intentional learning environments, and computer-supported collaborative work environments should support constructive learning.

Several case studies have reported using different collaboration technologies in education. For example, Sonnenwald et al. (1999) use several collaboration technologies (e.g. MBone for integrated synchronous audio- and video-conferencing, and Microsoft NetMeeting for electronic whiteboard and shared application tools) to provide university students in different countries with opportunities to participate in interactive class exercises and discussions, and to collaborate on class assignments. Rhode (2009) and Roberts et al. (2007) present the use of Wimba Classroom at Northern Illinois University and the University of Southern Mississippi in the United States respectively. Maneira et al. (2009) use Wimba Live Classroom in high-school education. These case studies report mostly positive results of using the on-line collaboration technologies in their education, such as improving communication quality and student learning. However, it is claimed that to realise benefits from the technology and effectively compensate for the limitations of the technology, students should be taught principles of collaboration, including accountability, trust management, commitment, respect, tolerance and appreciation of differences, adaptability, knowledge.
sharing and interpersonal communication skills (Sonnenwald et al. 1999).

5 Summary

This paper presents an informal evaluation of online collaboration software in the context of a Software Engineering course with both internal and external students. Combining face-to-face and online learning methods improves the amount and quality of communication between instructor and students for distance learning, and enhances the convenience and flexibility of the communication in general. Student satisfaction from the course was high and the collaboration technologies helped the students to achieve their goals from the course.

Wimba provided some immediate advantages for external students but it needs a more effective way to view/search recordings. There are limited benefits for internal students so far (they can join chat sessions and view recording of lectures and/or chats). We are currently investigating how to improve these limitations.

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7 References


