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Emerging Web Technologies and Their Use in Enhancing Course Content: An Experience Report

Jogesh K. Muppala and Chan Kin Kong
Dept. of Computer Science and Engineering
The Hong Kong University of Science and Technology
Clearwater Bay, Kowloon, Hong Kong
{muppala, oswin}@cse.ust.hk

ABSTRACT

Emerging web technologies including Blogs, Wikis, Podcasting and Social Bookmarks provide yet another opportunity for instructors in higher education to enhance their course content, by providing additional channels for information delivery to their students and enhancing collaborative and cooperative learning. In this paper we report our own experience at The Hong Kong University of Science and Technology with these new technologies. In particular we evaluate the use of blogs for delivering additional information like course announcements, links to interesting websites and articles relevant to the course. In addition we describe the use of podcasting as a means of delivering online recorded audio of classroom lectures to enhance the course materials. We achieved this with minimal institutional and infrastructure support in contrast to other such studies reported in the literature. We believe that these new technologies offer yet another opportunity of revolutionizing both traditional and online delivery of instruction to students.

1. INTRODUCTION

Web-based delivery [8] of course content, both in traditional and online teaching has become a standard in many universities around the world over the years. Emerging new web technologies [1], including Wikis [18], Blogs (or weblogs) [19], Podcasting [20] and social bookmarking provide exciting new possibilities for enhancing the delivery of course content online. While the (now traditional) use of web has been to deliver static content to the students from the instructors, the use of these new technologies enables the instructors and students to communicate, cooperate and co-investigate in their teaching and learning process. Efforts are underway at several universities around the world in exploiting and integrating these new technologies into their teaching and learning process.

The use of web feeds [4] enables automating the process of delivering content to the students. In particular, a student needs to simply subscribe to the web feeds (either in XML, RSS or Atom formats) provided by the content developer, through a feed aggregator (either through online news aggregators like bloglines or newsgator or through stand-alone feed readers or browser-integrated feed readers).

In this paper we describe our experience with integrating these new technologies in our course to provide additional channels for delivering information to the students. In particular we set up a course blog through which we deliver the course related announcements, answers to student questions, and links to interesting websites and articles related to the course. We also provide the course notes through an RSS feed which the students can subscribe and receive the course notes when they are made available online.

Furthermore, we explored the use of podcasting as a means of delivering the recorded audio of course lectures. The lectures were recorded while being delivered in the traditional classroom setting. We used a simple MP3 player (a Samsung Yepp YP-T6 MP3 player) to record the audio during the lecture. Thereafter the recorded WAV audio was converted to MP3 format and made available through a podcast that students could subscribe using their favorite podcatcher software like iTunes [7] or Juice. This enables them to automatically download

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the lecture audio and listen to the lectures at their convenience either using a MP3 player or a PC.

Interested readers can visit our course website [9] and the course blog [10] to see how we used these technologies to enhance our course. Also some reflections of the first author on his experiences can be found at the related blog [11].

All this was achieved with a single faculty member's personal initiative. We received no institutional support for our effort other than funding for conducting research and IT facilities to deploy the new technologies for use in our course.

This paper is organized as follows. Section 2 reviews some of the related work that has appeared in the literature. Section 3 provides the details of our project. Section 4 reflects on the students' opinions. Finally we give our conclusions in Section 5.

2. RELATED WORK

Alexander [1] reports that social software, like blogs, wikis, podcasting etc. have emerged as the new components of what has now been labeled as Web 2.0™ [13], the next generation of web technologies. He discusses several emerging technologies and their impact and implications to higher education.

Several authors have suggested the use of the emerging technologies in the teaching and learning process. In particular D'Souza [4] has written an interesting article on the use of web feeds in education. He explains the use of various emerging web technologies in the classroom. Similarly, Richardson's book [17] gives a detailed description of how these new technologies can be used for education. He also maintains an online resource wiki on the application of these emerging technologies in education at http://webloggedlinks.pbwiki.com/.

Podcasting is another technology that has attracted attention in the academia in the recent past. Chan and Lee [3] report on the use of podcasting in an information technology course. They do a comprehensive survey of the advantages and disadvantages of the use of audio in learning. They specifically studied the use of short audio clips delivered to students in order to alleviate the pre-class anxiety encountered by the students. They give a comprehensive background on the use of audio as an aid in the learning process from the tape recording era to the (now) podcasting era. It must be emphasized that while the use of audio or multimedia content in courses is not new, what is particularly noteworthy about the new technologies is that podcasting provides an excellent channel of delivering this content through subscription to the users' computers or portable media players. The delivery mechanism is the new innovation that has revolutionized the use of audio in education because it now provides an inexpensive medium for delivering the content to end-users.

Hartigan et al. [5] describe the use of podcasting at Brandeis University giving several examples of the usage. In particular they describe the use of podcasting by the students to contribute audio content to the courses. They describe both the technical and educational challenges that they encountered. Brittain et al. [2] present their experiences with using Podcasting at University of Michigan School of Dentistry. In particular they adopt the formative evaluation strategy to evaluate the use of appropriate technology to meet the students' need for access to lecture recordings. Through a series of three pilot studies, they concluded that lecture audio content made available to students through podcasting is the best solution. Similarly Osswald [14] describes the use of podcasting to engage his students in course content.

Similarly many universities have deployed institution-wide infrastructure to provide podcasting and elearning support for their instructors. See for example [6][22][16][15][21]. Such systems provide many facilities include automated recording and upload of audio and podcast of the lecture audio without the explicit involvement of the faculty. It must be noted that many of these initiatives require the setting up of large IT infrastructure together with dedicated IT support staff.

Even Apple is offering support for the use of podcasting in universities through its iTunesU program [7]. One successful use of the iPods in education at Duke University is described in [21]. This project involved distributing iPods to students and studying the various uses of the technology in the education process. Podcasting was one component of the overall research study.

For an ongoing comprehensive list of such resources, the readers are directed to our online bookmarks available at [12].

™ Web 2.0 is now a trademark of O'Reilly.

3. THE USE OF WEB TECHNOLOGIES IN OUR COURSE

In this section we describe how we employed the new technologies in our course at The Hong Kong University of Science and Technology. In particular we describe how we used blogs and web feeds to deliver course announcements and materials to the students. Also we explain how we used podcasting to deliver lecture audio. We give the technical details of how we employed these tools in our course.

We must again emphasize that the experience reported in this paper is based on a single faculty's initiative in the use of technology in education. Our experience sharing here is to illustrate how a single instructor with minimal institutional support can easily implement the use of these new technologies in their teaching. This is in contrast to university wide initiatives as seen in [6][22][16][15][21].

3.1 Blog

We set up a course blog [10] through which we delivered course related announcements, answers to student questions, and links to interesting websites and articles related to the course. Our information technology services center (ITSC) announced a pilot program providing selected users with the facility to set up personal blogs through their Blog@iHome service. The service was deployed using a popular blogging software called Blojsom (http://www.blojsom.com). This provided us a readily available platform to set up a course blog for our course. Blojsom provides a very intuitive user interface for bloggers to set up and administer their own blogs. In particular, it supports the use of categories for blog posts and supports web feeds of the blog postings using RSS, XML and Atom.

In our course blog, separate categories were set up for the course announcements, Q&A, and links to external sites. This enabled us to post regular course announcements which students could subscribe to keep themselves informed about the latest news about the course. We posted questions sent by the students together with our answers, to the course blog whereby all the students in the course could get access to this information. Both these methods enabled us to save significantly on sending out broadcast emails to the students. Very often emails get lost among the large volume of mails received by the users. On the other hand the course blog provides a centralized method of delivering the information. In addition a permanent record of the information is always available for the students at all times.

We also delivered links to interesting websites and articles relevant to the course together with our own comments about these resources to the students. This value added service enables a guided perusal of the materials available online. Indeed we could also use social bookmarking (see for example the use of Delicious (http://del.icio.us) to provide a somewhat similar service.

3.2 Podcasting

For many years our students have been requesting us to make our course lecture recordings (either audio or video) available for their use in revising and reviewing the course materials. So far we refrained from providing this mainly due to technological constraints and the prohibitive cost of providing such a service. With the advent of digital audio/video, the cost factor became less significant. However there still existed technological constraints in terms of efficiently and cost-effectively capturing and processing the audio/video and making it available online. The growing availability of inexpensive MP3 players with recording capability made it quite simple to capture, process and make the audio available through the Internet. In addition, podcasting provided us with a simple mechanism of delivering the content to users through subscription.

The course lectures were recorded while being delivered in the traditional classroom setting. We used a simple MP3 player (a Samsung Yepp YP-T6 MP3 player) to record the audio during the lecture. The quality of the recorded audio was quite clear and acceptable to the students. This player records the audio in WAV format (32 Kbps mono audio). Thereafter the recorded WAV audio was converted to MP3 format. The typical MP3 file size was about 15 Mb for a one hour of audio.

The audio files were made available online either for download directly from a website, or through a podcast that students could subscribe using their favorite podcatcher software like iTunes [7] or Juice (http://juicereceiver.sourceforge.net). This enables them to automatically download the lecture audio and listen to the lectures at their convenience either using a MP3 player or a PC. Post-processing

of the recorded audio and making it available online took about 15 minutes.

For podcasting the audio files, our department web server which hosts our course web pages was sufficient. No additional infrastructure to support podcasting was required. Podcasting required the setting up and editing of a simple XML (extended markup language) file containing the podcast information. We accomplished this by directly editing the file because we were familiar with XML syntax. Whenever a new audio file was uploaded, the podcast XML file was edited to add in the information pertaining to the audio file. For those unfamiliar with XML, several free podcasting tools are available which can be used to set up and manage a podcast.

3.3 Web Feeds with RSS

In all our courses we make the lecture notes/presentation slides available to the students in advance, typically in PDF format, for them to download, print and bring to class. This enables them to follow along the lectures and take additional notes on the printed slides as they feel necessary. These notes are typically uploaded to the course website a few days in advance. At the moment students visit the course website at regular intervals to check and download the course notes.

We set out to automate this check and download process through the use of the new RSS feed technology. We provided the course notes through an RSS feed which the students could subscribe using their favorite RSS reader or an online RSS aggregator. Whenever the course notes are made available online the RSS feed readers/aggregators will receive the update and notify the students. Some of the readers can automatically download the notes to the students' computer. Thus the students are freed up from having to actively monitor the course website for updates.

We set up the course notes RSS feed by making available the information using an XML file which contained the information about the notes in RSS format. We manually edited this file whenever new notes were put online. The notes in PDF format and the web feed file were hosted on our web server which supports the course web pages. This was straightforward and quick process for us because we were familiar with the XML syntax. This process can easily be automated through the use of automated feed generation tools, many of which are available.

4. REFLECTIONS

We tried out our ideas in an undergraduate course offered in our department in the Spring 2006 semester. This course is typically taken by junior/senior year undergraduate computer science and computer engineering students. The course had an enrollment of 36 students. During the semester, we noted our own observations and experiences with the technologies, and also carried out opinion surveys on the students to better understand their perspective on the new technologies.

Our experience with using the new technologies in the course has been very positive. The ability to deliver the content in the form of a web feed provides us with several new possibilities. Most of the earlier communications with the students for which we used email has now been replaced by the use of blogs. For example, course announcements, questions and answers and links to interesting sites and articles on the web could easily be delivered through the course blog. Students could subscribe to a web feed of the course blog whereby their feed readers will automatically download new items in the feed. The ephemeral nature of email communications is now replaced by the permanence of the blog where the information is available at all times, without the need of storing the information locally by each student. This also enabled us to reach a much wider audience than just the students enrolled in the course, as the information is available online for access by anyone interested.

Similarly the ability to provide the access to course notes using a web feed was also very useful. This enabled students to automatically subscribe to the feed and get notified whenever new notes are posted online. This freed us from the necessity to notify students after each upload.

Podcasting provided us with an excellent cost-effective and scalable method to deliver the lecture audio to the students. We found it quite convenient to use a simple MP3 player to record the lecture audio. This freed us from the necessity to install special hardware in the lecture room to record audio. The quality of the audio recordings thus obtained was clear and acceptable to the students.

We found that for podcasting and web feeds, the only infrastructure we needed was the standard web server. Since we were familiar with XML, we were

able to do podcast and web feed by creating a XML file and manually editing it rather than going through the whole process of setting up podcasting and web feed software. However, we recommend this option only if the instructors are familiar with XML.

We used student surveys as a method of understanding the students' response to the use of new technologies in education. In particular we were interested in better understanding how students used the lecture audio available through podcast in their own learning process. A survey was conducted at the beginning of the course to better understand students' familiarity with podcasting and the availability and usage of portable media players among them. An end-of-semester survey was carried out to better understand the students' experience with podcast during the semester.

Student response to the use of these new technologies was very encouraging. They found the web feed as a more convenient channel for information delivery. In particular they found the course blog to be a useful central location for course related information. The students used the commenting facility available in the course blog posts to comment on some of the questions and answers posted to the blogs and discuss further. Also some of the students appreciated the web feed facility provided by the blog which they could subscribe in order to get notified of new content.

Podcast audio of lectures was enthusiastically received by the students. Several interesting patterns and observations were made based on the students' surveys. We summarize some of the observations below:

1. Close to 70% of the students downloaded and listened to the lecture audio. Most of the time they listened to each recording once.
2. Typically the lecture audio was about 1.25 hours long. Most students downloaded and listened to only about 5-20 minutes of the audio. They often listened to only the portion of the audio that was specifically of interest to them, rather than the whole lecture. This seems to be mainly to review the hard-to-follow parts of the lecture and review the material.
3. Surprisingly most students listened to the lecture audio on their personal computers (80%) rather than portable audio devices. This is in contrast to observations in other places where portable devices seem to be the favored listening option. Our surveys did indicate the prevalence of portable media players, especially MP3 players among the students. However most of them considered them as entertainment devices and did not envisage them as being useful in education.
4. The above point leads to an interesting related observation. Many students found that listening to the complete lecture audio was not useful. Instead they wished to review only a part of the audio. On a portable audio device, fast forwarding and rewinding functions are not supported, and hence they are not conducive to this mode of listening. A PC, on the other hand, enables us to select and listen to only a portion of the audio. This seems to support the reason for students favoring the PC as the listening device.
5. Another related observation was that students found it difficult to find the specific location within the audio file which corresponds to a particular slide used in the lecture presentation. Thus they preferred some kind of indexing or synchronization of the audio file with the PowerPoint presentation. This kind of synchronization cannot be provided on a portable media player. But, this is possible on a PC. The students' expectations are higher because of the capabilities of the device on which they listen to the lecture, in this case a PC. In addition some students preferred video recording rather than audio, again seemingly related to the use of PC. We are not sure whether this is related to the fact that the students in our class were computer science/engineering majors and hence spent a significantly higher time in front of a computer. This is an issue that we will investigate further.
6. Many students prefer to listen to the lecture as a way of reviewing the materials covered in the class. This provided them additional reinforcement for their understanding of concepts as they could always revisit our lectures and review the materials that they found difficult to understand the first time around. The students found this to be very useful especially when they were reviewing the materials for examinations. Further evidence corroborating this fact is that most students mentioned that more often they listened to the audio just before examinations.
7. Students also expressed the opinion that the availability of the recorded audio gives them

the confidence that they can always review a difficult concept again just in case they do not understand it in the first time. This also takes pressure off of them from having to take detailed notes during the lecture which might detract their attention from the lecture.

8. Opinions have been expressed by many educators that the availability of lecture audio or video may encourage students to skip classes. In our own experience, this effect was not that perceptible. There was an insignificant drop in class attendance. Students themselves seem to express the opinion that the availability of lecture audio does not seem to have any major impact on their decision to attend or skip lectures. While the availability of the lecture audio does take the pressure off of them especially if they occasionally miss a lecture, but it does not seem to promote absenteeism. The students seem to value the in-class interaction and classroom dynamics a lot more and see it as a valuable component of their learning experience.
9. One of the major points being mentioned in favour of podcasting and making available lecture audio is the fact that students who are non-native English speakers would definitely find it beneficial. They may not be able to keep up with the pace of the lecturer's teaching in English. Hong Kong offers an excellent experimenting ground for this theory. Tertiary (university) education in Hong Kong is taught exclusively in English. However most of the students entering the university here have received their schooling mostly in their mother tongue, which in this case happens to be Cantonese. They do find some difficulty in adjusting to being taught in English. Very often the students' command over English is not very good. Added to this, they are now faced with being taught in English by faculty members who hail from all over the world, some of whom are not necessarily native English speakers. With recorded audio, they get to listen to the lectures again to fill in the parts they found difficult to follow in the first place.

Our survey of the students' opinions, attitudes and listening habits indeed helped us to better understand their needs and gave us suggestions about possible improvements that could be effected in the future. Many of these observations lend additional point of validity to similar observations of educators elsewhere. Some of our findings were quite surprising and not necessarily in conformance with the observations elsewhere.

5. CONCLUSIONS AND FUTURE DIRECTIONS

In this project we demonstrated how a single instructor, with limited infrastructure support, can easily adopt the new web technologies for teaching and learning activities. We reviewed the use of emerging web technologies in our course which enabled us to provide additional channels for interaction among the instructors and students. In particular we reviewed the use of course blog and web feeds as new channels for information delivery to the students. We also reviewed the use of podcasting as a means of delivering recorded lecture audio to our students. Several interesting observations regarding our own experiences and the students' opinions on the use of the new technologies are presented in the paper. Our experience offers one point of reference for academics interested in using these new technologies. With more experience gathered worldwide and sharing of such experiences, we can better promote the use of new technologies to enhance higher education.

We plan to continue our investigations into the use of these new technologies on a larger scale in the future to gather more experience and evidence to advocate widespread adoption of the new technologies. We are also investigating the use of integrated e-learning platforms like Moodle (http://www.moodle.org), or the Sakai project (http://www.sakaiproject.org) to see how we can find better tools for widespread adoption of the new technologies without educators explicitly needing to learn the technical details of podcasting and blogs. We are also investigating the pedagogical aspects of these problems, including what kind of learning activities are more conducive to the adoption of these new technologies. We will report more on our findings and experiences in future international fora.

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