Podcasts as a supplement in tertiary education: an experiment with two Computer Science courses

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The current generation of undergraduate students are enthusiastic adopters of mobile technologies, and some of these technologies offers significant opportunities for broadening the times, places and manner that students study and learn. One of these is podcasting, which greatly eases distribution of content to portable devices, giving the students opportunity for anytime, anywhere learning. However, most educational podcasts do not take advantage of the potential of podcasting. In this paper we discuss the issues surrounding the use of podcasting for higher education. We report our experiences using podcasts to supplement two undergraduate Computer Science courses, and we provide tips for others considering the use of podcasts in education.

1 Introduction

Podcasting is an asynchronous mode of distributing multimedia files – "podcasts" – over the Internet using syndication feeds, for playback on portable devices and personal computers at the user's convenience. It has much potential as a highly mobile learning tool, and yet almost all applications of podcasting in university education fail to exploit the potential as they simply broadcast lectures (which are visual and even kinesthetic experiences) as a podcast (which is primarily an audio experience). Some educational podcasts compensate for this by including images, video, and/or web links. However, we believe that there is value in creating audio-only podcasts that supplement the lectures, so that mobile learning can occur in a "hands-free, head-up" mobile situation to enable students to learn also during activities such as commuting.

Despite the audio-only limitation of podcasting, it is attractive for education because it potentially enables students to increase the number of hours of studying without necessarily having to remove something from their schedule such as doing household chores, or exercising. And although we advocate a supplement to lectures, the time required to prepare the extra material in such a podcast need not be too demanding on the lecturer. There are some restrictions on what is possible with mobile podcast listening: the student is not likely to be able to take notes or look up references. A related issue is that it can be difficult to elicit a response because the user may not be in a position to use email or even send a SMS message at the time they are listening, and are likely to forget to do it when they have the opportunity later.

In this paper we review the ways that audio podcasting might be used in an educational setting, particularly in a tertiary environment. We also report the results of experimenting with podcasting as a supplement to two first-year Computer Science courses with approximately 150 and 250 students respectively.

2 Podcasting

The normal process for podcasting is that a content provider (podcaster) will make the files available on the Internet via an RSS (Really Simple Syndication) feed, to which the audience subscribes using aggregation software (a podcatcher). When a new podcast is published, it can be automatically uploaded to their portable device and hence they can listen to it at their convenience. Normally subscriptions are free, and there are no direct costs for listening to podcasts. Podcasts are typically provided in a heavily compressed MP3 format and can be played on a wide variety of devices, many of which are available inexpensively. Students are likely to already own something suitable. In addition, any desktop computer with Internet access is bound to be able to play a podcast, which means that owning a portable player isn't essential.

Podcasting is a relatively recent phenomenon; the first RSS audio feeds appeared in July 2003 (Doyle 2005) and by mid-2005 there were approximately 10,000 different podcasts available on a wide range of topics. In June 2005 Apple added podcasting to their free "iTunes" program, and this provided a surge of interest – within two days Apple announced that a million podcast subscriptions had been made. In December 2005 the editors of the New Oxford American Dictionary announced "podcasting" to be the word of the year and it appeared in the dictionary in 2006. Many podcasts have irregular and/or very limited followings, but some have hundreds of thousands of downloads of each episode. Their content and frequency is diverse, from hourly 3-minute newscasts, through daily 20 minute commentaries, to weekly one-hour in-depth discussions. Free software is also available for podcast creation, and there is also a lot of material on the Internet (including in podcasts) explaining how to make your own podcast. For users with an Internet connection, a desktop computer with a soundcard, and a relatively inexpensive microphone, the main additional cost to produce a podcast will be a relatively small fee required to have the files hosted on a server with a plan designed for the large number of downloads that podcasts can get, such as "Liberated Syndication" (http://libsyn.com).

3 Using podcasts in education

A key benefit of podcasting is that it enables students to listen to course related material while they are engaged in other activities. In the past a highly motivated student might have used such time for revision of their lecture notes, or reading literature references, but the use of digital media players provides a level of portability and ease of file transfer that has not previously been feasible. Also, the use of a feed such as RSS coupled with an aggregator such as iTunes means that the material can be pushed onto the student's portable device. By having files pushed like this, users are more likely to listen to them because they need not remember to carry out an explicit download.

The medium does have disadvantages, such as the lack of visual content, the difficulty of taking notes, and the divided attention of the listener between environmental distractions and the material on the podcast. Also, the material will be of most benefit to auditory learners, and does not appeal to all students. Despite these limitations, there are many opportunities for using podcasts as a supplement while giving a course. You can use them to give out news and updates, answering questions sent in (for example by email), and/or give general feedback to students. Another possibility would be to

highlight the key points you stated in class and have extended discussion about them, and/or conducting interviews with external people adding or reinforcing the material addressed. Podcasts is also a way of providing hands-free instructions to students conducting laboratory work or using different computer programs. In addition we can imagine letting students do project reports using podcast as they develop good oral skills and share their experience with the others. In the wider educational setting podcasting could be used for recruiting and marketing, recording meetings and conference talks, and broadcasting for specific groups such as alumni, sports teams, or cultural groups.

Despite this rich range of potential applications, currently the most common approach to podcasting at universities is to provide the students with the traditional lectures as a podcast. This does have some value, giving them a second, or first if they missed it, chance to listen to it, which is particularly appreciated by students whose first language is not English. In many cases it also means that people outside the university community can benefit from having access to the lectures. However, this does not represent a major advantage over existing lecture recording systems that publish the audio or even video on the web.

4 Podcasts at other institutions

A number of institutions have started to offer podcasts. Duke University's "Duke Digital Initiative" was one of the first institutional experiments with ubiquitous portable audio devices, when in August 2004 all of the first-year students were given a 20G iPod to use as a learning tool (Duke University 2005). The intention was to facilitate innovative use of technology on Campus. Applications that emerged included course content dissemination, classroom recordings, field recording, study support and, file storage and transfer. The students found the iPods useful for study support by using them for repeated listening, audio books, going over rehearsals (drama and music), and vocabulary lists. However, there were relatively few Podcasts (three podcasts were reported after the first year), and it appears that the major educational use was more student-driven: 60% of students reported using their iPod for recording material, and 28% for music and hard drive storage. A total of 75% reported using it to support their learning.

A number of universities have started making some of their lectures available to the general public through podcasting. For example, Harvard is into the second year of podcasting their course "Computer Science E-1, Understanding Computers and the Internet" (http://www.fas.harvard.edu/~cscie1/), and it has many followers – it has appeared in iTunes' top 100 Podcasts. Berkley University has among 30 faculty members who have agreed to clip on a microphone in class so that their courses' audio can be recorded and then posted online (http://itunes.berkeley.edu/). Princeton University's University Channel (http://uc.princeton.edu) let different universities contribute recordings of lectures, seminars, panels and interviews to a virtual pool of academic content under their own name.

The public podcasts of lectures allow anyone to sit in ("audit") a course, albeit without the full student experience. Access to these lectures in a mobile environment is valuable for the casual listener, and particularly for other educators who can pick up pedagogical

ideas by listening to another teacher at work. This open-source ethos is to be applauded, and reinforces the idea that institutions should control qualifications, not the knowledge itself. It can also improve the quality of the education since the teacher is exposing their teaching to such a wide audience, increasing the opportunity for feedback.

University of Southern California had two 2006 spring courses with lecture podcasts being evaluated and according to Wolff (2006) the outcome was positive in both cases. However the reasons differed as one course had a large number of students for whom English is a second language who listened to the whole lectures again, while the participants of the other course valued having the recording to replay specific explanations to understand difficult material.

From an online survey for the podcast pilot in 2005 at University of Washington, Lane (2006) reported that 70% of the students found that podcasts supported their learning and to be helpful when preparing for homework and exams. The response rate was low, 41 out of 148 enrolled students completed the voluntary survey, but can indicate the perceived value of podcasts. Interestingly, 81% of students used a desktop computer rather than a portable player to listen to their podcasts. It appears that when listening to a lecture podcast, it is valuable to sit at a desk and use notes and handouts, in which case a desktop computer provides a better interface for listening to audio than a portable device. This reinforces our contention that simply podcasting lectures does not take full advantage of the potential of podcasts to facilitate mobile learning, and for this application learning may be better facilitated by using tools such as the Audio Notebook (Stifelman *et. al.* 2001) and AudioGraph (Jesshope 1999), which provide a richer capture of the lecture.

Furthermore, making lectures available in a flexible manner can potentially inhibit learning. Students can postpone listening to lecture material indefinitely. In an earlier experiment with video-recorded lectures, we observed exactly this behaviour: once the video-lectures were made available, attendance at lectures dwindled because the students could catch up through the video at any time, but they never realised their intention to do so (Bell *et. al.* 2001). This is not likely to be a problem for motivated students (e.g. for mature students and/or professional courses which could benefit greatly from this mode of getting lecture material), but for less mature students we suggest structuring curriculum delivery in a way that encourages them to keep up with the class schedule.

5 Podcasting experiment

To evaluate the potential of podcasts as supplementing lectures, we ran a podcasting experiment for two first-year Computer Science courses, COSC122 (algorithms) and COSC110 ("Working in a digital world"), at the University of Canterbury, New Zealand. Approximately 150 and 250 students were enrolled in the courses respectively. We released weekly podcasts that *supplemented* the lectures rather than record them in their entirety. We did, however, also provide three recorded lectures for each course, without announcing our intention to do so, to see whether students would take the opportunity to review the material.

At the start of the COSC110 we surveyed students to determine what sort of access they had to digital audio players, and if they had any experience with podcasts. We found that 64% of the students had a portable device, and that 82% regularly listen to audio on a computer. Those that had portable devices estimated that they spent an average of 7.6 hours per week listening to them, and 16% reported listening to them for 10 or more hours per week. The most popular situation for listening to them was while walking (33%), but other activities are popular too, including on the bus and in the car (21% each), while exercising (15%) and on a bike (10%). Only 13% of the students had listened to a podcast before, and only 3 students in the class reported listening to podcasts daily. This is likely a reflection of the lack of adoption of podcasting in New Zealand due to relatively high charges for Internet use. Despite the lack of experience with podcasts, 87% of the students reported that they intended to listen to the first podcast.

The initial survey also asked students to report their level of interest (5-point Likert scale from 1 for not interested to 5 for very interested) for three types of material in the podcast. The number of students showing an interest level or 4 or 5 (i.e. more than neutral) was 50% for recordings of lectures, 72% for summaries and extra information, and 65% for topical issues relating to the course, indicating a student preference for the supplements, although the inevitable demand for re-runs of lectures.

Both courses were given weekly podcasts. The COSC122 podcasts were about 20 minutes long, with one presenter, while the COSC110 podcasts used two presenters, and ranged from 15 minutes to almost one hour. The entire fourth podcast of COSC122 is accessible as an example at www.cosc.canterbury.ac.nz/tim.bell/podcastExample.mp3. The COSC110 podcast was made available to the public through http://uccsse.libsyn.com/ For both podcasts, the general format was to review the material from the past week, discuss topics coming up later in the course, remind students about any deadlines and provide discussion about current topics, especially if they related to current events. Each COSC122 podcast had a competition with a small prize to encourage students to email in their comments. In one of the COSC122 podcasts a section of the course text book was read aloud (with some additional commentary).

The podcasts were recorded using digital audio editing software, with a studio microphone. Off-site interviews were recorded with a portable digital audio recorder, although there are many other devices including mobile phones, laptops and digital cameras that could be used for this. A theme tune was used to add interest, provide context, and give personality to the podcast. It was also useful for covering background noises such as pages being shuffled. Interviews were edited into the podcast – in fact, many of the COSC110 interviews were recorded as one of the authors traveled around the world, which demonstrated truly mobile teaching with several interviews recorded on a conference on a ship on the Yangtze river, as well as commentaries recorded while waiting at airports. Although intricate editing is possible with the software we were using, the podcast genre typically has a "live" style, with minor glitches left in the recording. Recording in one take makes creating the podcast much less effort, and gives a personal and dynamic feel to the episode. Podcast recording software such as "Castblaster" and "PodProducer" assume this one-take mode of operation, whereas editing systems such as "Audacity" and "Garageband" encourage the podcaster to edit

the content. We found that interviewees were often a little nervous as it was a new experience, and in these cases the offer to edit out any hiccups was greatly appreciated. Generally very little editing was needed once the interview got underway.

For COSC122 we were able to compare actual downloads with the students' expectations in their survey. Unfortunately in the first week of term a major server crash occurred that made access to the podcasts very difficult for students. However, in the second week when the system was working properly, the second podcast was downloaded 69 times, which compares favourably to the 87 students who said they intended to download it, although it represents just under a half of the class, and we were unable to count unique downloads. The three lectures were downloaded 37, 33 and 33 times each, which is under half the download counts for the first five podcasts (50, 76, 35 (missing data in the logs), 79 and 73).

The COSC110 podcast was made available to the outside world through iTunes, and the number of downloads often exceeded the number of students in the class. Feedback from outside listeners included one ex-student who was using the podcast to catch up with developments since they took the course.

Feedback and Summary Questionnaire: We were keen to receive feedback from the students to gauge the podcasts' effectiveness and to help us tailor future podcasts to better suit their needs and desires. We tried a variety of techniques to encourage feedback, including a draw for free coffee for students who emailed or text-messaged us to say they had listened. Response rates to the draw were very low, with only two to five responses per week, but low response rates are a known phenomenon for podcasts, even when they are heavily downloaded. One explanation for the low response rates is that listeners are often occupied with other activities (such as walking, cycling and driving) making it inconvenient to respond on impulse. The few responses we did receive were generally positive. Giving answers to student questions in the podcast was well received, and the summaries and extra information seemed to be the most valuable. Reading from the text book drew one unfavourable comment despite it representing a genuine time-saving for students who intended to read the text anyway. Some students asked for all lectures to be made available, although we chose not to for the reasons given earlier. Some students worried about the cost of downloads, although in fact we had set it up so that it would be free.

After five weeks of podcasting COSC122 (including the three sample recorded lectures), we administered a questionnaire in a regular lecture to gain insights into the extent of use of the podcasts, the students' on-going intentions, and their perceptions of the podcasts they had listened to. 56 completed surveys were returned --- approximately 38% of the class. Of those, 37 (66%) reported that they had not downloaded any of the podcasts. The most common reason given for not downloading the material was that they "still plan to" (16), and that they had problems accessing the podcasts from home (13). Four stated that they "were not interested", five stated that they forgot, and six stated they had "technical problems". This suggests that if we overcame technical problems and made it easier for students to remember to download then the number who used the podcasts could more than double, and the majority of the class would be listening to podcasts. This is likely to be the case as the technology matures.

Nineteen participants (34% of responses) stated that they had downloaded some or all of the podcasts. Of the five podcasts, most people listened to all of the material, except for podcast 2, which had a higher 'switch off' rate. This is unsurprising as podcast 2 included the relatively long (8 minutes) reading from the text book; but it shows that students' tolerance for "dull" podcast material is relatively low.

We asked five questions regarding the problems that they had encountered with the podcasts, again rated on a five-point Likert scale from 1 (major problem) to 5 (no problem): remembering to download, remembering to listen, quality of audio, finding a device and getting distracted. Of these, remembering to download was the biggest problem (mean 3.5, s.d. 1.5), followed by getting distracted (mean 3.7, s.d. 1.2) and remembering to listen (mean 3.9, s.d. 1.0). Neither quality of the audio (mean 4.7, s.d. 0.6) nor finding a device (mean 4.4, s.d. 1.2) appeared to be a major problem for these respondents who had successfully accessed the recordings. The relatively high problem rating for getting distracted is a concern, particularly because students may be listening to the lectures while carrying out activities such as cycling and driving.

The COSC110 class used a different format, with a 2-person discussion which usually went for 30 to 60 minutes. Informal feedback from students indicated that this is too long for many, and that the podcast should be kept short and to the point.

It was clear from the feedback that there is a small but significant group of students who have almost no interest in this mode of learning, but those that regularly used the podcasts the feedback was extremely positive, including comments such as "Great — keep it up!" and "Nice addition to study kit".

6 Conclusions

These experiments with podcasting indicate that it can be a low-effort and effective supplement, but not substitute, for traditional lecture-based courses. The students who used our podcasts greatly appreciated them, and many of those who had not yet accessed the recordings indicated that they thought it was potentially useful and interesting, and that they intended to access them "later".

A number of suggestions for podcasts content are given earlier in the paper. In the light of our experience we offer the following tips for those considering using podcasts to supplement introductory undergraduate courses:

- Keep podcasts short and to the point – 15 minutes per week is probably about right for most students unless the podcast is expected as part of the contact time for the course.

- Use a system such as RSS to push the information out to students; this is likely to result in a higher uptake than if they students have to manually download the files.

- Be aggressive in overcoming technical problems at the start, such as making sure files are easy to download both on-campus and at home.

- Include motivating material in the podcasts such as interviews and topical news articles.

- Maintain a live feel to the podcasts, and inject personality. Recording the podcast with minimal editing dramatically reduces the work for the producer and creates a dynamic mood for the episode. Apart from the initial overhead of setting up the recording system and background music, the time taken to produce a podcast will not be much longer than the podcast itself.

- Do not be surprised or concerned about low response-rates to requests for feedback in the podcasts. This is a known phenomenon for the podcast medium. Based on our experience, podcasts seem to be an attractive tool to help engage students, build a class "culture", and disseminate the important and fascinating problems that the discipline addresses.

If you are podcasting recordings of lectures, students are more likely to be listening to them in a non-mobile situation because of the length and to avoid the distractions of a mobile environment, in which case you should consider posting other course materials online as most students will be at a personal computer and can make use of links to other references.

We hope that we will see more podcasts that supplement courses rather than just take audio content from lectures, as we believe that this adds considerable value, and need not be onerous to produce. This could range from a cognitively demanding podcast such as teaching a language, through to lighter material such as interviews with practitioners that can be followed despite the distractions present in a mobile environment, giving a good return to the student for a relatively small investment of time and effort.

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