

REINFORCING STUDENT LEARNING EXPERIENCES IN BIOCHEMISTRY THROUGH PODCASTS AND MOBILE LEARNING

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ABSTRACT

This paper presents evidence from a pilot podcasting study undertaken in 2007 and 2008 in a core biochemistry unit within the course structures of applied science, nutrition and human movement studies degree programs. The aims of the study were to generate educational podcast resources that reinforced conceptual teaching and learning in biochemistry and determine students' attitudes to the perceived usefulness and benefit of educational podcasts. Podcasts were recorded (MP3 audio files) separately from the didactic lecture program in biochemistry. Subsequent to the weekly lecture, podcasts were integrated within the resources presented to students through their learning management system (Blackboard) and made available through RSS feeds. The vast majority (>88%) of students utilised the podcast resources, indicating a high level of uptake for this portable educational technology amongst the student cohort. The respondents reported that podcasts focussed their attention to core learning concepts and supported their understanding and learning of the lecture material. In addition, the survey data showed that respondents agreed strongly that podcast resources assisted with study and revision for examinations and, somewhat surprisingly, there was a perception that podcasts positively impacted on examination performance. Overall, student users perceived that educational podcasting could be used as an effective and valuable tool for their learning and understanding of biochemistry.

KEYWORDS

Educational technology, Podcast, Mobile learning, Online learning, Learning management systems, Blackboard, Perceived benefit

BACKGROUND

The application of podcasting as an educational technology is a rapidly growing method of delivering audio (and video) content online in a downloadable format to the user's computer or other portable wireless device, such as digital media players. Once generated, podcasts can be disseminated on a routine basis via automatic subscription services (such as RSS feeds). Podcasts are, therefore, examples of a "push" or "subscription" rather than a "pull" technology (Campbell, 2005). This characteristic differentiates podcasting from alternative methods of distributing audio content to students, for instance, uploading of audio files or streams to learning management systems. Such alternative methods may require multiple steps to access the resource or may be relatively static in that streaming resources and they will require a computer with a reliable broadband connection. These issues can contribute to student dissatisfaction or lack of participation. In contrast, podcasting seamlessly delivers portable educational content directly onto students' computers via an RSS feed (Brittain et al., 2006; Maag, 2006). Podcast audio files can then be downloaded to portable media players (iPods and MP3 players) that can be taken anywhere, providing the opportunity for "anytime, anywhere" learning experiences (mobile learning). Overall, podcasts are a superlative educational tool, since learners can access the material, listen to or watch podcasts using either personal computers or portable devices.

Biochemistry is a core study area in the vast majority of undergraduate programs in the life sciences, as well as being a foundation study area in many allied health-related undergraduate programs, such as pharmacy, nutrition and dietetics, and a constituent part of the preclinical sciences in professional medical programs. Biochemistry is a subject that consists of information-dense course content with a reliance on a significant amount of descriptive and illustrative visual material. Basic biochemistry courses can often have large enrolments (>200 students) and comprise students from a diversity of degree programs. Under such circumstances, the students from the separate degree programs may display disparate abilities, and it is possible that their demands for teaching and learning resources may be different. These issues represent some of the challenges that biochemistry teachers will encounter. Consideration of these challenges can advance the effective management of student groups and help develop successful teaching and learning strategies, which may ultimately lead to positive outcomes for the teaching of biochemistry. In recent years, electronic and multimedia technologies have transformed the educational landscape and expanded the available options for the delivery of information to students. Furthermore, electronic pedagogies are being used to engage students both inside and outside the classroom. Although some educators have embraced podcasts and used them as their primary means of communicating with students, others have primarily used them to supplement class or lecture materials so that students can advance their understanding of concepts, theories and applications (Shim et al., 2006). Consequently, I decided to trial the use of educational podcasts in the biochemistry course that I teach. Critically, the primary objective was to provide podcast resources that reinforce and augment conceptual teaching and learning in biochemistry. To achieve this objective it was decided that the podcasts would not simply be recordings of the weekly lecture material. Rather, the podcasts would summarise and emphasise the key learning concepts from the lecture material and complement the lecture notes uploaded to Blackboard. To evaluate the implementation and general effectiveness of this strategy the students' attitudes to the perceived usefulness and benefit of educational podcasts was determined.

METHODS

Podcasts were generated to enhance and reinforce the teaching and learning of a core biochemistry unit (Metabolism). This biochemistry unit is an advanced (2nd level) undergraduate unit with enrolments of 130-160 students. These students are largely from applied science, nutrition and human movement studies degree courses.

The pedagogy underpinning these educational podcasts involved the creation of audio recordings that emphasise the key concepts and summarise the significant learning outcomes within the learning material. In this way the podcasts aim to complement and augment the lecture notes uploaded to Blackboard. Podcasts were prepared in 2 steps. Firstly, the lecturer prepared a written script; this script emphasised and reinforced key concepts, theories and objectives in the lecture note resources provided for the students. Secondly, podcasts were recorded as MP3 audio files separately from the didactic biochemistry lecture program using a headphone/microphone set and Audacity (an open source audio recording and editing program; <http://audacity.sourceforge.net>). In practice, the lecturer recorded these podcasts using a personal computer in their office. These podcasts were uploaded to the learning management system (Blackboard) after the scheduled lecture (usually within 3-4 days). Enrolled students were alerted to the availability of the downloadable podcast through the RSS subscription service and they could also download podcasts directly from the Blackboard site.

Students enrolled in this core biochemistry unit (both 2007 and 2008) were studying in the following degree programs: Bachelor of Applied Science; Bachelor of Health Science (Nutrition and Dietetics)/Bachelor of Applied Science (Human Movement Studies); Bachelor of Health Science (Nutrition); Bachelor of Health Science (Nutrition and Dietetics).

Students were surveyed on their opinions and use of podcasting in both 2007 and 2008. Survey questions included yes/no type questions, questions presented using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), and an open-ended question used to gather further comments, criticism or insight. In 2007 the cohort size was 135 students and the number of survey respondents was 92; in 2008 the cohort size was 145 students and the number of survey respondents was 78. This represented 68.1% and 53.8% for the 2007 and 2008 cohorts, respectively, enrolled in biochemistry units.

RESULTS & DISCUSSION

The surveys captured responses and comments from 50-70 % of students enrolled in the biochemistry unit. Crucially, the data (Table 1) revealed that >88% of respondents listened to more than one podcast in both 2007 and 2008; only 11.9% and 11.5% of respondents in 2007 and 2008, respectively, stated that they did not listen to any podcasts. Furthermore, the number of respondents that listened to most or all of the available podcasts was 76.1% and 79.5% in 2007 and 2008, respectively. These data indicate a high-level uptake and acceptance of podcasting, suggesting that students enrolled in biochemistry are motivated to make use of podcast resources to reinforce their learning and understanding.

The surveys attempted to gain some insight into the podcast listening habits of students by asking when, where and how students actually listen to the podcasts (Table 1). In addition, the survey inquired whether students had encountered and listened to educational podcasts in their previous studies (Table 1, Question 3). The evidence indicated that respondents were relatively evenly split on this question with approximately 50% respondents answering 'yes' and approximately 50% answering 'no'. This evidence implies that a large number of students are familiar with and motivated to use podcasting technology in their studies, however an equal number of students have had no experience of educational podcasts. The vast majority of respondents (78.3% and 78.2% in 2007 and 2008, respectively) listened to the podcasts using a home computer. Fewer respondents indicated that they listened to the podcasts on a mobile digital media device (20.7% and 21.8% in 2007 and 2008, respectively). Students were also asked whether they listened to the podcasts using university or library computers and the respondents clearly indicated that this option was the least popular. Personal computer ownership is high, especially among student populations, and recent studies have reported that approximately 75% of learners own digital media devices, such as MP3 players (Evans, 2008). Overall, the evidence from this study suggests that the majority of students may prefer to listen to the podcasts in a home study environment using a personal computer. Although podcasts are mobile learning resources that can be listened to using digital media devices, such as MP3 players, it is possible that students prefer to listen to their biochemistry podcasts whilst reviewing their lecture notes on their personal computer, which were uploaded to the Blackboard site in a downloadable pdf document format. The survey also questioned students about their activities whilst listening to the podcasts (Table 1, Question 6) and the responses appeared to corroborate the findings that many students listen in a home study environment using a personal computer. The majority of respondents indicated that they 'listen and take notes or update my class notes' (54.3% and 67.9% in 2007 and 2008,

respectively), whereas only a small percentage of respondents indicated that they listen to the podcasts at times when they are not normally studying (12.0% and 12.8% in 2007 and 2008, respectively). Interestingly, a very high level of respondents indicated that podcast listening occurred largely while studying for examinations (60.9% and 70.5% in 2007 and 2008, respectively).

It has been mentioned previously that the biochemistry podcasts were recorded from a written script that emphasised and summarised the key concepts relating the lecture material. In this way the podcasts complemented and augmented the lecture notes that were provided for the students. It is important to point out that the lecture notes were only representative of the material covered in the lecture and not comprehensive; the lecture itself often covered concepts and topics in greater detail and presented additional information to that contained in the lecture notes. Under such circumstances the lecturer emphasised that the podcasts (and the lecture notes) are not a replacement for lecture attendance. Accordingly, the podcast to accompany the weekly lecture ran for 20-30 min, whereas the weekly lecture had a duration of 2 hours. To these ends the survey explored the student's opinions on the time duration of the podcast resources, with the respondents overwhelmingly endorsing the podcast duration of 20-30 min (Table 1, Question 7).

The student opinions on podcast usefulness and their perceived benefit were further explored with a set of questions presented on a 5-point Lickert scale (5= strong agreement). Table 2 shows the outcomes generated in response to 4 key questions focussing on podcast usefulness and perceived benefit. Overall, respondents agreed to high levels that:

- the podcast resources helped to focus attention to the core concepts of the lecture material (4.5 and 4.2 in 2007 and 2008, respectively)
- the podcast resources developed their understanding and learning of the lecture material (4.3 and 3.9 in 2007 and 2008, respectively)
- the podcast resources helped in the revision of lecture material for examinations (4.5 and 4.4 in 2007 and 2008, respectively)

Table 1. Student survey responses to questions on use and benefit of podcast resources respondents for 2007 survey = 92 (total cohort size = 135); respondents for 2008 survey = 78 (total cohort size = 145).

Question and Option	% of Total Respondents	
	2007	2008
1: Which one of the following best describes the way you have used and listened to the podcasts:		
• I never listened to any podcasts	11.9	11.5
• I listened to one podcast and then did not listen again	11.9	9.0
• I listened to most of the podcasts	25.0	51.3
• I listened to all of the podcasts	51.1	28.2
2: How did you listen to the podcasts? (may pick more than one)		
• Home computer	78.3	78.2
• University / Library computer	15.2	14.1
• iPod or other MP3 player	20.7	21.8
3: Have you listened to educational podcasts prior to this unit?		
• Yes	53.3	52.6
• No	46.7	47.4
4: Did you know that your coordinator was creating lecture summaries in the form of podcasts?		
• Yes	98.9	98.7
• No	1.1	1.3
5: Rate the overall value of the podcasts you have listened to.		
• Excellent value	45.6	32.1
• Above average value	41.3	38.5
• Average value	13.0	24.4
• Below average value	0	1.3
• Poor – not interested	0	3.8
6: Indicate your activities when listening to podcasts. (may pick more than one)		
• I just listen to part of the podcast to clarify a point	29.3	9.0
• I listen to all the podcast to see if I missed anything	54.3	46.2
• I listen and take notes or update my class notes	58.7	67.9
• I listen multiple times to a single podcast	32.6	10.3
• I listen if I missed a class	2.2	3.9
• I listen at times I am normally not studying (commuting to/from university, walking the dog, etc.)	12.0	12.8
• Most podcast listening while studying for exams	60.9	70.5
7: The podcasts summarised the lecture material into a timeframe of 20-30 min. The duration of the podcasts was:		
• Too short	7.6	7.7
• Too long	2.2	2.6
• About right	90.2	89.7
8: Would the availability of lecture podcasts make you more or less likely to enrol in a class/unit?		
• More likely	19.6	23.1
• No effect on decision	79.3	74.4
• Less likely	1.1	2.6

Overall, the outcomes shown in Table 2 indicate that podcast resources can be utilised positively to assist learning and understanding in biochemistry, and, importantly, revision for examinations. Interestingly, a marked number of respondents further agreed (3.9 and 3.5 in 2007 and 2008, respectively) with the statement that "*Listening to podcasts helped me achieve a higher mark in exams*", suggesting that the podcasts have a positive impact on the students perceptions of performance in examinations.

Table 2. Student responses to podcast usefulness and perceived benefit survey data were determined from a 5-point Lickert scale and presented as mean scores \pm standard deviation. A score of 5 equals strong agreement and a score of 1 equals strong disagreement.

	Question Score (scale of 5 max.) \pm S.D.	
	2007	2008
The podcasts help focus my attention to the core concepts of the lecture material	4.5 \pm 0.7	4.2 \pm 0.6
The podcasts helped my understanding and learning of lecture material	4.3 \pm 0.7	3.9 \pm 0.6
The podcasts helped me revise the lecture material for exams	4.5 \pm 0.7	4.4 \pm 0.6
Listening to the podcasts helped me achieve a higher mark in exams	3.9 \pm 0.9	3.5 \pm 0.9

One cautionary note is that despite student perceptions that podcasts assisted their leaning experiences, exam revision, and, even, exam performance, we have seen no evidence for the achievement of higher marks by the student cohort in 2007 and 2008, when compared to marks from 2006 (Table 3). Over this period of time (2006 - 2008) the overall unit structure and content has remained relatively constant, with the main innovation being the introduction of podcast resources in 2007. Table 3 clearly shows that the average final marks (%) in 2006, 2007 and 2008 are comparable and similar numbers of students achieve marks \geq 75% (Grades 6 and 7).

Table 3. Student performance in Biochemistry: 2006 - 2008. A 7-point grading system is used, where a grade of 6 (Distinction) is representative of a mark between 65-74% and a grade of 7 (High Distinction) is representative of a mark between 75-85%.

Year	Cohort Size	Average Final Mark (% \pm S.D)	% Students Achieving Marks \geq 75% (Grades 6 and 7)
2006	117	73.8 \pm 10.6	48.8
2007	135	75.3 \pm 10.2	50.4
2008	145	74.2 \pm 11.4	46.0

Educational podcasting is a relatively inexpensive venture since it requires little more than a personal computer and some form of audio recording device, however it does require a significant time commitment for the recording, editing and uploading via RSS subscription services. In the present venture, the time and effort invested into the project in the initial stages was substantial since it involved the writing of a script that emphasised the key concepts and learning outcomes embedded in the lecture notes, followed by the audio recording (using Audacity), post-production editing and the posting of the files. Importantly, the writing of a script enabled the recording of an upbeat and relatively word perfect product that was engaging for the students and maintained attention levels over the 20-30 minutes of the audio recording. It is estimated that the initial workload involved in generating each 20-30 minute podcast was in the order of 5-6 hours. Consequently, it is possible that for many lecturers, this level of time investment could preclude a venture into educational podcasting as set out in this study. However, the model advanced in this study is just one of many that is being reported on at educational conferences and within the pages of educational journals. It is worth pointing out that once the initial time and workload has been invested into generating educational podcasts for a particular unit or course that future rerecording, editing and uploading via RSS feeds consume considerably less time and energy, but generate equivalent benefits for the students. Ultimately, the success of educational podcasting ventures will rely on facilitating the processes involved in developing these resources and this will involve support and sustenance at the Faculty and institutional level (for example, Brittain et al. (2006)).

Podcasting can potentially offer many benefits to educators. It provides a low-cost flexible method to distribute audio (and video) content seamlessly to student groups. Consistent with previous findings (Baird and Fisher, 2006; Evans, 2008), the present study found that podcasting generally helped students engage with and learn their course content. Furthermore, student learning using podcasts has the benefit that it is mobile and can be used at times at locations convenient to them. It has also been reported that podcasts can make learning material accessible to a greater diversity of students (Cebecci and Tekdal, 2006).

It is apparent that podcasts may be utilised by students to enhance the revision process for examinations and, somewhat surprisingly, students perceive that listening to educational podcasts may improve their own performance in examinations. It is generally acknowledged that the revision and examination periods are a time of higher stress for students, and in agreement to the observations of Evans (2008) it is possible that educational podcasts may help to reduce level of student anxiety at such times, and, as a consequence, students may feel more confident in their learning and develop a perception that podcasts improve their exam performance. Clearly these are interesting phenomena that deserve further investigation.

In summary, students have readily accepted and embraced podcasts to reinforce their learning and understanding in biochemistry. Moreover, it is strongly evident that students perceive podcasting as a quality educational tool that offers convenience, flexibility and portability (mobile learning).

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