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The effectiveness of m-learning in the form of podcast revision lectures in higher education

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Abstract

In this paper we describe a study of the effectiveness of mobile learning (m-learning) in the form of podcasting, for teaching undergraduate students in Higher Education. Podcasting involves downloading a series of audio or video broadcasts (files) onto a digital media player, via a computer, over a period of weeks. These can then be watched or listened to when, where and as often as students choose. The use of digital media players, popularised by Apple's iPod™, is widespread amongst undergraduate students. A pilot survey of Business and Management students indicated that over 74% owned some form of digital media player, with a further 7% indicating that they intended to purchase one in the next six months.

Whilst podcasting is being utilized as a teaching tool by some educators in the secondary sector, its use in higher education, and its effectiveness as a learning tool for adults, remains to be established.

In our study, a separate group of just under 200 first-level students were given a series of revision podcasts after completing a course in Information and Communications Technology (and prior to their examination). As part of the subscription process, they had to complete an online questionnaire about their experience. The questionnaire utilized a five-point Likert scale comparing their attitudes to lectures, podcasts, notes, textbooks and multimedia e-learning systems.

Statistical analysis of the results of the study indicates that students believe that podcasts are more effective revision tools than their textbooks and they are more efficient than their own notes in helping them to learn. They also indicate that they are more receptive to the learning material in the form of a podcast than a traditional lecture or textbook. The study suggests that the use of podcasts as a revision tool has clear benefits as perceived by undergraduate students in terms of the time they take to revise and how much they feel they can learn. Coupled with the advantages of flexibility in when, where and how it is used, podcasting appears to have significant potential as an innovative learning tool for adult learners in Higher Education.

Keywords: Adult learning; Distance education and telelearning; Evaluation of CAL systems; Human–computer interface; Teaching/learning strategies

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1. Introduction

The development of the Internet has created new ways for educators to communicate with learners. Many Higher-Education institutions have adopted the use of virtual learning environments and incorporate e-learning into their traditional teaching mechanisms as part of a blended-learning approach. Compared with traditional lectures, e-learning has the advantage of allowing learners to choose (within constraints) when, where, and how they study. It also allows learners to review material and gain feedback (Evans & Fan, 2002). Mobile learning (m-learning) inherits these advantages from e-learning, but extends their reach by making use of portable (handheld) wireless technologies. Suitable devices include digital media players (e.g. iPods, MP3 players), smartphones (e.g. Blackberry, iPhone), and Personal Digital Assistants or PDAs (e.g. Palm, Pocket PC). One of the key benefits of these devices is that they allow learners to vary their study location and to study "on the move". Modern learners have increasing demands on their time and are often forced to study in their lunch breaks, in the evenings and at weekends; and to study at work or on the bus, train or in the car (in addition to conventional lecture theatres or the library). The use of portable technologies makes it easier for learners to study when and where they want by making it simple for them to transport their learning materials. They also facilitate "just-in-time" learning where learners can often take advantage of unexpected free time since they frequently have their devices with them. The ability to study whilst travelling on transport uniquely distinguishes m-learning from e-learning, since (with the possible exception of the more cumbersome laptop) the latter normally requires access to a desktop computer and wired Internet access.

Podcasting is a form of m-learning in which a device is used to listen to or watch an audio or video broadcast. Broadcasts are published on the Internet and automatically downloaded on to a desktop or laptop computer. They may then be automatically copied on to a handheld device when the learner next connects it (for synchronization). The learner can then choose when, where and how to listen to or watch them. The term "podcast" originates from the combination of the brand name of the currently most popular player ("iPod™") with "broadcast". Podcasts have an additional advantage, which is largely unexplored in this study, of being a "push" or "subscription" rather than a "pull" technology. That is, the material is delivered directly from the source Internet location to the device, rather than requiring the learner to seek it out and download it (Campbell, 2005). This reduces the overhead experienced by the learner in having to search for, locate, and retrieve material. Whilst maximum benefit comes from downloading podcasts onto a portable device, it is usually also possible to listen to or watch them using a PC. This makes them an ideal educational tool, since learners without portable devices are not prevented from accessing the material.

The proportion of learners already owning suitable devices appears to be very high. In our pilot study of 60 level-two Business Computing students, we found that 74% owned an iPod (or equivalent), with a further 7% expressing their intention to buy one within six months. In April 2007, Apple announced that it had sold over 100 million iPod devices since they were introduced in 2001. It is therefore unlikely that any limitation to the growth of podcasting as a learning technology can be explained in terms by the absence of suitable devices.

There is a growing body of literature regarding the use of audio and video players (such as iPods) for academic purposes. However most of the material takes the form of magazine articles or project reports. For example, Duke University was one of the first institutions to explore the educational use of iPods and podcasts in its Duke Digital Initiative (Duke, 2005). Blaisdell (2006) outlines a number of institutions that have since followed suit. Amongst the more scientific studies, Chan and Lee (2005) describe the effects of podcasting in helping to reduce student anxieties. Miller and Piller (2005) argue that supplementary podcasts can increase students' satisfaction ratings. Edirisingha and Salmon (2007) found that podcasts contributed to informality and engagement. Cebeci and Tekdal (2006) describe how podcasting can make material more accessible to a wider diversity of learners. Boulos, Maramba, and Wheeler (2006) discuss ways in which podcasts can be combined with wikis and blogs to enhance the learning experiences of students, clinicians and patients in the health industry. Baird and Fisher (2006) found that podcasts can be effective in enhancing student engagement and reflection. Dale (2007) describes how supplementary podcasts can help meet the needs of modern learners in the form of Level One students on an undergraduate degree in Tourism.

In their review of podcasting technology, Ractham and Zhang (2006) suggest that producing podcasts is relatively easy for educators. This seems to be borne out by Malan (2007), who describes a study into the effectiveness of podcasting of lectures at Harvard University. Traditional lectures were recorded and then podcast

to allow students to review them if they wished. He found that students valued the flexibility that the podcasts offered particularly with regard to review rather than as an alternative to attendance. Interestingly, he found that publishing the podcasts increased subscribers by 100-fold from the 60 actually enrolled in his class to over 6000 from all over the globe. Kurtz, Fenwick, and Ellsworth (2007) extended this process to convert an entire lecture course into 65 podcasts, allowing class time to be dedicated to problem-solving and project sessions. They found that students who received podcast lectures had higher overall grades than those from a previous cohort who received conventional lectures.

In this study, we investigated the use of podcasts as a revision tool used by learners after their traditional lecture course has finished, but before their final examination. We were particularly interested in learner perceptions of the technology and adopted a learner-centred design in which we asked them to comment on learning characteristics of conventional materials (revision lectures, notes, textbooks) and also on podcasts so that we could contrast them. Previous studies in e-learning (Evans & Gibbons, 2007; Evans, Gibbons, Shah, & Griffin, 2004) have suggested that well-designed virtual learning materials, by increasing the amount of control learners have over the learning process, can be more efficient and effective than traditional alternatives. They also suggested that through effects such as interactivity and personalization, they can increase learner engagement and receptivity.

Coupled with observations made during the pilot study, this led us to make four specific predictions for the benefits of podcasting over traditional revision mechanisms. These related to their efficiency (the time spent studying for a given amount of learning), their effectiveness (the amount of learning achieved for a given amount of material), their receptiveness (the amount of learning expected for a given amount of material), and the learner's perceived relationship with the lecturer when listening to them. Six experimental hypotheses were formulated in four categories as follows:

H1: Learners believe that it is quicker to revise from podcasts than from notes.
H2: Learners believe that revising from podcasts is more effective than from notes ($H2_{notes}$) or from a textbook ($H2_{text}$).
H3: Learners feel more receptive to revision material delivered as a podcast than in a traditional revision lecture ($H3_{lecture}$) or a textbook ($H3_{text}$).
H4: Learners feel they can relate more to the lecturer in a podcast than in a traditional revision lecture.

The first hypothesis relates specifically to comparing podcasts with notes rather than textbooks or traditional revision lectures, for two reasons. Firstly, like notes, the time learners choose to spend learning from podcasts is flexible: they can pause or repeat them as often as they like (this is not true of a traditional lecture). Secondly, like notes, podcasts are designed to summarise the material in some way (traditional textbooks do not provide such summaries, although more learning-oriented ones may do).

The second hypothesis compares podcasts with both notes and textbooks, rather than revision lectures. The reason for this was that the actual revision tools available to students for the module involved in the experiment did not include revision lectures.

The third hypothesis compares podcasts with textbooks and revision lectures. The reason for this is that they are all alternative forms of direct communication between the educator and the learner (the learner's notes are indirect because the information has been partially processed by the learner before being written down).

The fourth hypothesis considers less the actual mechanism of delivery, as the learners' relationship to the educator behind that mechanism. It only considers podcasts and revision lectures (not notes or text books). The reason for this is that both involve an element of personal communication through the voice (and for video podcasts, image) of the lecturer. This form of communication includes verbal cuing and intonation (and for video, visual cues) that are not accessible through the other mechanisms.

One of the difficulties in carrying out research into the impact of innovative learning technologies is controlling the variable of delivery mechanism. Whilst it is relatively easy to locate a group of learners who have not yet been exposed to a given learning technology, it is almost impossible to find a suitable group who have not been exposed to traditional alternatives. Furthermore, whilst our primary motivation was to determine the effects of using revision podcasts, our secondary motivation was to attempt to improve the learning in one of

our taught courses. In keeping with our learner-centred approach, we therefore adopted an action research methodology (Reason & Bradbury, 2001) in which learners were invited to become active participants in the study to investigate whether podcasting would enhance their learning experience.

2. Method

2.1. Participants

The participants were 196 volunteers from a class of 401 first-year undergraduates in Business and Management at a university in London, UK. Ninety-six were female and 98 were male (two did not specify). Their ages ranged from 18 to 25, with a mode of 19 and mean of 19.27. Participants were all at the same level in their studies and had met the same pre-requisites. This sample was chosen for this study, as there was a mix of students some of whom would later specialise in Business Computing and a large majority who would not. In practice a much larger number actually accessed the podcasts but did not participate in the survey.

2.2. Materials and apparatus

The students were not provided with any special equipment to access the podcast episodes. However they all had access to 60 networked Viglen PCs running Windows™ 2000 in two separate laboratories as well as open-access PCs in other parts of the campus. Many of the students will have preferred to use their own desktop PC or laptop. A pilot survey of level-two students suggested that 70–80% of them possessed an iPod (or equivalent) and it was expected that an equal or greater proportion of the level-one students would also (the survey did not ask this as it would be difficult to estimate the proportion of non-participants that possessed iPods due to the self-selection process). Students were provided with a simple guide telling them how to access the podcast episodes via a PC or using an iPod, but were not otherwise given any special support. For consistency, an RSS feed was not provided as one of the episodes was to be inaccessible until they had completed an online survey delivered using the module's virtual learning environment (WebCT™). Requiring them to manually access the episodes allowed conditional access to be given. The survey contained fifteen five-point Likert-scale questions, two open-ended questions and six demographic questions (see Appendix).

The podcasts were recorded and edited using GarageBand™ on an Intel MacBook Pro running Mac OS X (10.4). They were uploaded to the Web using Cyberduck™ 2.7.3. Each podcast consisted of a 5-min MP3 audio recording of the course lecturer reviewing the learning outcomes and adding clarifications.

2.3. Procedure

The participants were given access to a series of three podcasts released at one-week intervals in the revision period after teaching had finished but before their examination. In order to access the third podcast, students had to submit answers to the online survey. The URL of the remaining podcast was provided as feedback. The online discussion board was carefully monitored to attempt to prevent students circumventing the survey by circulating the URL. All three podcasts continued to be available until the day of the exam.

2.4. Data analysis tools

Statistical analyses were performed treating the data non-parametrically, since, strictly speaking, Likert scales provide ordinal rather than interval data. However, similar results are obtained when parametric analyses are carried out.

Significant differences between their Likert ratings were assessed using a one-tailed Wilcoxon signed rank test for pair-wise comparisons. A one-tailed test is chosen because all they experimental hypotheses are directed, predicting higher rankings for questions relating to podcasts compared to other delivery mechanisms. All statistical tests were performed with an α value (significance) of .05.

Analyses were carried out using SPSS 12.0.

Table 1
Ranked questionnaire results

	Positive ranks	Negative ranks	Ties	Z	Significance
iPod quick – notes quick[a]	85	56	54	−2.934	.002*
iPod effective – notes effective[a]	63	60	73	−0.553	.291
iPod effective – textbook effective[a]	90	43	63	−3.924	<.001*
iPod receptive – lecture receptive[a]	68	34	92	−2.394	.009*
iPod receptive – text receptive[a]	64	34	94	−3.592	<.001*
iPod relate – lecture relate[b]	48	49	98	−0.812	.417

[a] Based on negative ranks.
[b] Based on positive ranks.
* Significant at $p < .05$.

3. Results

Out of the 194 students, 20% of them indicated that they listened to the podcasts on an iPod (14%) or other MP3 player (6%). The remaining 80% listened to them on a PC via the Web page. This is consistent with Malan's study (2007) in which 29% used iPods and 71% used their PCs.

Descriptive statistics for individual questions were analysed non-parametrically using the mode rather the mean. In response to the statement "I think it is important to be able to listen to podcasts where and when I want", the average (mode) response was "agree" (54%, with a further 25% who "strongly agree"). For, "I listen to the podcasts while travelling", the mode was "neutral" (34%, with 25% "agree" or "strongly agree"); and for "I listen to the podcasts whilst doing something else" the mode was "disagree" (27%, with a further 14% "strongly disagree"). The full range of the five-point scale was used by students in each case.

We wanted to know whether learners thought that revising using podcasts was quicker, or more effective, and whether they felt more receptive to them than when revising using traditional alternatives. Additionally we wanted to know whether learners thought they could relate to the educator better through a podcast than in a traditional lecture. We tested these hypotheses by comparing learner ratings given for pairs of questions contrasting podcasts with one of the traditional alternatives.

Table 1 shows the number of students who gave a higher rating to podcasts (+ve ranks), the number who gave a lower rating (−ve ranks) and the number who gave equal ratings (ties). A one-tailed Wilcoxon signed rank test showed significantly more students thought that revising from podcasts was quicker compared with revising from notes. Significantly more students thought that podcasts were more effective than revising from textbooks. Finally, significantly more students believed that they were more receptive to the material delivered as podcasts than either textbooks or traditional revision lectures. No significant differences were found for effectiveness of podcasts compared to revising from notes or the ability to relate to the lecturer when listening to a podcast compared to a traditional lecture.

4. Discussion

The results show that students value the flexibility offered by podcasts in terms of the ability to study when and where you want. One quarter of them listened to them whilst travelling. In London, at least, the cramped conditions of public transport and the visual demands of driving a car would mean that this would not normally be possible using the traditional revision tools of textbooks and notes. Travelling is often a time when people engage in less cognitive activity. This suggests that podcasting can fill an important needs gap by allowing learners to continue the learning activities when it might not normally be possible. However, podcasts did not appear to offer much in the way of facilitating multi-tasking, with most people claiming that they did not undertake any other activities whilst listening to podcasts.

The question about listening to podcasts whilst doing something else was an attempt to draw out whether the mobile features of podcasting translate into any other activities than just travelling. With most people disagreeing, the indications are that travelling is the main mobile benefit.

The overall research aim was to determine whether revision podcasts enhance the learning process. The results provide support for three out of the four hypotheses suggesting that they do. The answers to the first pair of questions in Table 1 indicates that students believe that revision podcasts are a quicker way to revise than using their own notes (hypothesis H1). Podcasts are self-contained broadcasts that immediately engage the learners with the outcomes of a given lecture. By contrast, revising from your notes requires learners to expend cognitive energy in re-familiarizing themselves with the material in the context in which they first encountered it. This also assumes that the notes that they revise from were created by themselves. With competing demands on students' time, it is not uncommon for a given student to have to revise from a set of notes taken by a colleague, since they were unable to attend a given lecture. The ability to revise without have to re-contextualise yourself offers significant time savings for learners.

The results from the second and third pairs of questions in the table indicate that the students report that podcasts are more effective revision tools than textbooks ($H2_{text}$), but not their own notes ($H2_{notes}$). This means that they claim that they learn more from the podcasts than reading the corresponding section from the textbook. The flexible nature of podcasts may mean that it is easier for learners to actively engage with material than when reading. The fact that they report that they do not find podcasts more effective than notes suggests that the summarising format of the podcasts was of particular benefit in helping learners focus on the important aspects to the subject without getting sidetracked by detail.

The results from the fourth and fifth pair of questions indicate that the students report that they were more receptive to podcast material than material delivered in the form of a revision lecture or from the textbook (H3). All of these are forms of direct communication between the educator and the learner. This suggests that learners may feel more engaged when listening to a podcast. Through giving learners more control of the learning process, podcasts can encourage the development of an active relationship with the material. By contrast, textbooks and lectures can encourage a passive relationship in which the learner takes the role of a simple recipient of information. Until recently, perhaps, the primary role of lectures and textbooks was seen as delivering large amounts of information. By contrast, the podcasts were specifically designed to help learners assimilate the material and construct their own understanding.

The results from the last question pair provide no evidence in support of the hypothesis that it is easier to relate to the lecturer in a podcast than in a revision lecture. This suggests that lectures are just as effective at personalising the material as podcasts.

Taken together, these results provide good evidence to suggest that students think that podcasts enhance their learning process, as reported in their responses.

One alternative interpretation of the "quickness" results is that it is merely indicating the fact that the podcasts do not last very long (they each have a duration of about 5 min). If this were the case, then you would reasonably expect the data to reflect the belief that the podcasts are less effective since students would typically spend longer revising from their notes. However, the answers to the questions about effectiveness showed no evidence that they find the podcasts any less effective. This suggests that a better interpretation is that they find podcasts to be *more efficient* revision tools. Future studies will involve questionnaires that draw out efficiency as opposed to duration, perhaps by getting students to consider equal time periods of study for each. They should also measure the number of times students carry out repeat listenings to the podcasts in an effort to measure the total listening time.

An alternative explanation for the belief that podcasts are more effective than the textbook is that this is because they are geared towards assimilating and re-presenting course content (i.e. revising). This would explain why there was no evidence for them being more effective than revising from notes. With hindsight, it might have helped to include a question about the effectiveness of traditional revision lectures. However, in combination with the evidence that students are more receptive to material in podcasts than in revision lectures, it would appear that students feel more engaged and this may be a better explanation for why they believe them to be more effective revision tools.

One of the difficulties with conducting investigations into innovative learning technologies, and indeed action research methodology in general, is that students may be giving what they consider socially acceptable responses, favouring podcasts over traditional methods. In and of itself this would actually provide some support for the research hypothesis, in that they would thus be indicating that they believe that podcasting is more socially acceptable. Delivering revision material using the more socially acceptable medium must surely

enhance the learning process. However, if students were genuinely favouring podcasting as a medium over traditional alternatives, you would expect this to be reflected in all their responses. However there were two instances in which there were no significant differences in comparisons of the two media: comparing the effectiveness of podcasts with their notes ($H2_{notes}$) and comparing receptiveness of podcasts with revision lectures (H4). This suggests that they are more discerning in their answers, and cannot be dismissed as merely giving the socially acceptable response.

The results suggest that students find podcasts to be efficient, effective, engaging and easily received learning tools for revision. This is consistent both with Baird and Fisher (2006) and Edirisingha and Salmon (2007) in their reports that learners found podcasts helped them engage with the material. It also supports Miller and Piller's (2005) observation of increased student satisfaction ratings. The revision period is usually a time of high stress for students prior to their examinations. The results thus also reinforce the idea that podcasts might contribute to a reduction in student anxiety as found by Chan and Lee (2005). The use of the podcasts whilst travelling makes them more accessible than some of the traditional alternatives. This means that they can accommodate a wider range of learning practices. This is consistent with Cebeci and Tekdal (2006) in their findings that podcasts make material accessible to a wider diversity of learners.

Podcasting appears to have significant potential for enhancing the revision process. Future investigations are planned to consider the use of podcasts to support international Business students in developing their subject specific study skills. Overseas students, whose first language is not English, often have difficulty in acquiring these skills during their first year in English-speaking universities. Like revision, this involves the process of distinguishing important information from detail. Such students often benefit from the ability to record and replay lectures multiple times. As such, podcasts may also have a significant effect in enhancing their learning.

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Appendix A

Podcasting revision lecture survey

Where not otherwise indicated, questions use the following five-point Likert scale:
(a) Strongly disagree, (b) Disagree, (c) Neutral, (d) Agree, (e) Strongly agree

1. Are you (a) female (b) male
2. What age are you (in years)?
3. The number of months I have been listening to podcasts is...(a) 0–5 (b) 6–11 (c) 12–17 (d) 18-23 (e) 24 or more
4. I used the following to listen to the revision podcasts provided for this module(a) iPod (b) Another MP3 player (c) I only listened using my PC
5. I think reading from my notes is an effective way to revise
6. I think reading from the textbook is an effective way to revise
7. I think listening to the podcasts is an effective way to revise
8. I think it is important to be able to listen to the podcasts where and when I want
9. I listen to podcasts whilst travelling
10. I listen to the podcasts whilst doing something else
11. I think that reading my notes is a quick way to revise
12. I think that listening to a podcast is a quick way to revise
13. I have listened to the first podcast...(a) Zero (b) Once (c) Twice (d) Three or more times
14. I have listened to the second podcast...(a) Zero (b) Once (c) Twice (d) Three or more times
15. I intend to listen to some of the podcasts again
16. I feel I can relate to the lecturer in a traditional revision lecture

17. I feel I can relate to the lecturer in a revision podcast
18. When revising, I feel receptive to learning material in a traditional lecture environment
19. When revising, I feel receptive to learning material when reading a text book
20. When revising, I feel receptive to learning material when listening to podcasts
21. Are there any other comments you wish to make about your experience of revision podcasts?
22. If you are willing to take part in a short interview, please enter your email address below

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