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Subject: Podcasting, higher education, student-generated content, self-regulated learning, self-directed learning, active learning
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Listen and learn: A systematic review of the evidence that podcasting supports learning in higher education

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Abstract: Among the raft of social software tools that accompany the Web 2.0 revolution, podcasting technology has the potential to support learning in a range of settings and across multiple disciplines. This paper outlines innovative uses and applications of podcasting, with a particular focus on the higher education sector. In particular, the paper focuses on enhancing learning by using the technology not to merely deliver lecture content to learners, but to enable greater learner self-regulation. Examples are provided where learners have both control and agency in creating and distributing audio content of their own. Pedagogical applications that enable active learning through audio learning are discussed, with an emphasis on the use of the technology to facilitate the creation of learner-generated content that supports self-directed learning.

Keywords: Web 2.0, social software, podcasting, learner-generated content, self directed learning

Audio as an educational technology

It has been noted by some researchers that audio has been somewhat overlooked and underused as a teaching and learning medium (Bates, 1981; Romero-Gwynn & Marshall, 1990). One explanation could be the view that listening is not equated with active learning, and that is passive rather than active (Clark & Walsh, 2004, p. 25). However, Durbridge (1984) emphasises the educational advantages of audio over printed media: as comprehension is enhanced by the spoken word, thereby improving cognition by adding clarity and meaning. Audio materials offer a large number of advantage to the learners including time and place flexibility, personalisation and ease of use (Laaser, 1986) In support of these advantages, McCarty (2005b) notes that audio therefore “represents a great leap in sensory input over text” (p. 68).

As early as the 1920’s, audio technology attracted the attention of researchers as a mode of learning and to improve comprehension. Radio has been used in education ever since it became available, for a variety of purposes ranging from on-campus school and university broadcasts to in-service teacher support and training and adult literacy and basic education campaigns (World Bank, 2000). In combination with tutorials, print materials, local listening groups, and face-to-face meetings, radio has been used to teach a wide range of subjects at various levels of the education system. Audio cassette tapes, and more recently, optical recording media such as CDs, have been used as a solution where the ephemeral nature and fixed transmission times characteristic of radio broadcasts (World Bank, 2000) pose a problem, where the audience is geographically dispersed over too large an area, or where radio air time is simply not readily available. Learners see cassettes as more personal and informal than radio, and cassettes have also been found to be more appropriate than audio for controlled, didactic teaching (Power, 1990, citing Bates, 1981). Podcasting may offer the “best of both worlds” in audio technology by combining the benefits of the broadcast nature of radio with the flexibility, learner control and personalisation afforded by recorded audio.

Podcasting terms explained

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Podcasting allows users to receive new audio material on their desktop computers automatically by subscription. It offers a low-cost, low-barrier solution for the timely delivery of fresh content as it becomes available, for transfer to or synchronisation with a portable device when the user is next able to physically access his/her computer. The editors of the New Oxford American Dictionary declared “podcasting” the “Word of the Year” for 2005 (Oxford University Press, 2005); they defined the term as “a digital recording of a radio broadcast or similar program, made available on the Internet for downloading to a personal audio player” (para. 1). This is but one testament to the burgeoning growth of the technology and its au courant status in mainstream society. In fact, the word “podcast” has spawned a number of associated words, each with a particular meaning as Table 1 displays.

The popularity of podcasting has resulted in a situation whereby many authors, educators and educational technologists tend to use the term very loosely to refer to any digital audio content that is broadcast over the Internet (for which the correct term is “audiocast,” as can be seen in Table 1). One definition that remains true and accurate to the use of the word by its originator, Adam Curry (2004), is that proposed by Dixon and Greeson (2006). They highlight three key characteristics of podcasting:

1. It uses file-based downloads – As opposed to streaming, which by definition means playing the media as it downloads, podcast files are downloaded in their entirety before they are consumed;

2. It is subscription-based – The user pre-selects one or more feeds or channels of his/her choice and podcasts are automatically “pushed” to his/her computer on a regular schedule;

3. The content is consumed on portable devices, such as dedicated MP3 players (including but not limited to iPods), mobile phones, as well as personal digital assistants (PDAs) that have MP3 playback capabilities. However, according to a survey by Bridge Data (n.d., cited in Dixon & Greeson, 2006) more than 80% of podcast downloads never make it to a portable player or another device – they are consumed on the PC, or perhaps never listened to.

The subscription-based download of podcast media files is made possible by Really Simple Syndication (RSS) (RSS Advisory Board, 2005), a technology originally designed to facilitate the syndication of text summaries of additions to frequently updated websites, such as news sites. RSS 2.0 feeds permit the inclusion of enclosures, which in the case of podcasts are simply references to MP3 audio files. A podcast-aware aggregator or “podcatcher” application on the user’s desktop is configured with the URL of the feed(s) to monitor for newly added MP3 enclosures.

<table>
<thead>
<tr>
<th>Term</th>
<th>Likely origin / source</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podcast</td>
<td>Curry (2004)</td>
<td>A portmanteau that combines the words “iPod” (the name of Apple Computer’s popular music player) and “broadcast.” Podcasts are typically audio files in MPEG Layer 3 (MP3) format.</td>
</tr>
<tr>
<td>Audiocast</td>
<td>Unknown</td>
<td>Any digital audio content that is broadcast over the Internet. The term serves as somewhat of an umbrella term for audio content that is distributed through various mechanisms, including podcasting, streaming, etc.</td>
</tr>
<tr>
<td>Enhanced podcast</td>
<td>Apple Computer (2005)</td>
<td>An (audio) podcast synchronized with static images such as artwork, photos, or slides. (Not to be confused with a vodcast, which contains video content.) Apple’s proprietary MP4a format is typically used, which also allows the inclusion of chapter marks (used to divide a lengthy podcast into sections) and clickable hyperlinks.</td>
</tr>
<tr>
<td>Vodcast</td>
<td>van der Ziel (2005)</td>
<td>The publishing/syndication of video files instead of audio files using the same technology as podcasting. Sometimes also referred to as a “vidcast.”</td>
</tr>
<tr>
<td>Screencast</td>
<td>Udell (2004)</td>
<td>A type of vodcast that contains a (video) recording of the activity on a computer screen, possibly with an audio track consisting of sound output from the computer whose screen is being recorded, or from an external source, such as voice narration or music.</td>
</tr>
</tbody>
</table>
Narrowcast | Unknown | Refers to audio or video programs (such as many podcasts or vodcasts) that target a specific audience demographic, as opposed to a broadcast, which is pitched at a mass audience.

Skypecast | Skype Limited (2006) | A conversation conducted over the free Voice over Internet Protocol (VoIP) service Skype (Skype Limited, 2007) that has been recorded and made available as a podcast.

Mobcast | Carvin (2005) | A podcast created using a mobile phone (smartphone). The term combines the concept of mobile podcasting with “Smart Mobs” (Rheingold, 2002), which is used to describe self-structuring social organization and collective action enabled by the use of modern ICTs.

Palmcast | Unknown | A podcast that is created and/or consumed using a Palm Pilot or similar Personal Digital Assistant (PDA).

Punchcast | Unknown | A term used to describe the process of downloading a podcast or vodcast from a media server on the Internet, directly onto an Internet-connected mobile device (such as a PDA or smartphone), without the use of a desktop or laptop computer. Punchcasts can be either live or recorded for on-demand use following the live broadcast.

Phonecast | PhoneCasting LLC (2007) | A form of punchcast which specifically involves Internet transmission of audio or video content directly to a mobile phone.


Autocast | Mike (2005) | An automatically generated audio podcast, created by processing textual information such as blog entries using a combination of software including XML parsers, text-to-speech software, and audio conversion utilities (Autocast, 2007).

<table>
<thead>
<tr>
<th>Institution</th>
<th>Country</th>
<th>Description</th>
<th>Creator of content</th>
<th>Literature reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia College &amp; State University</td>
<td>USA</td>
<td>Since 2002, various courses, including a number of study abroad courses, have been “iPod-enhanced” to include a diverse range of audio material ranging from lectures and audio books to language study material and music.</td>
<td>Mixed – Appears to be primarily instructor</td>
<td>Georgia College &amp; State University (2005)</td>
</tr>
</tbody>
</table>

**Table 1. Some podcasting-related terms**

**Usage and uptake of podcasting in higher education**

Fuelled by the ubiquity of MP3-capable portable devices with increasingly large storage capacities, as well as the availability of multimedia hardware and software that simplifies the digital audio production process, there has been significant uptake of podcasting in higher education. According to the 2006 Horizon Report (The New Media Consortium, 2006), “[personal broadcasting such as podcasting is] at the leading edge of a wave that will last for the next several years and beyond” (p. 11). However, there is still a relatively limited amount of academic literature and empirical research in this area. The authors searched the AACE Education and Information Technology Digital Library (Ed/ITLib DL), as well as a number of other sources, and found a number of recent educational applications of podcasting.

It appears that most existing educational uses of podcasting in higher education focus on “lecturecasting,” that is, the use of the technology to deliver instructional or lesson content, which can lead to questions of pedagogical soundness. In many cases, lectures are being recorded and podcast so that students can listen to them (again) later at their own convenience. Table 1 outlines some of the more innovative uses of podcasting that go beyond the mere use of the technology as a distribution mechanism for lectures.

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<table>
<thead>
<tr>
<th>Institution</th>
<th>Country</th>
<th>Use Case</th>
<th>Role</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duke University</td>
<td>USA</td>
<td>In August 2004, Duke distributed 20-gigabyte iPods to its 1,650 commencing students, pre-loaded with orientation information. Administrative and academic materials in MP3 format were made available for students to download from the Duke Web server and via Apple iTunes.</td>
<td>Instructor</td>
<td>Duke University (2006)</td>
</tr>
<tr>
<td>Drexel University</td>
<td>USA</td>
<td>Drexel distributed iPod Photo players to its School of Education freshmen in September 2005. Read (2005) reports that there were plans for a variety of learner-centered applications, including but not limited to having students record study-group sessions and interviews, as well as having them maintain audio blogs to connect with administrators and peers during the work experience semester.</td>
<td>Mixed – Appears to be primarily learner (planned only – unable to locate evidence of actual implementation)</td>
<td>Read (2005)</td>
</tr>
<tr>
<td>Charles Sturt University</td>
<td>Australia</td>
<td>Second year undergraduate students take charge of producing talkback radio-style podcasts to assist first year students undertaking a unit that the former group previously completed.</td>
<td>Learner</td>
<td>Chan &amp; Lee (2005); Lee, Chan &amp; McLoughlin (2006)</td>
</tr>
<tr>
<td>Swathmore College</td>
<td>USA</td>
<td>Students studying a literature course read short passages aloud and record them as podcasts, as well as creating separate podcasts discussing the passage they chose to read and its relationship to other material.</td>
<td>Learner</td>
<td>Evans (2006)</td>
</tr>
</tbody>
</table>
| University of Connecticut        | USA     | Three types of podcasts are used to support a General Psychology course:  
- *iCube podcasts* – Informal discussions with students following each week’s lectures;  
- *Precasts* – Short enhanced podcasts previewing material prior to each lecture;  
- *Postcasts* – Short podcasts created after certain lectures, containing re-explanations of selected concepts. | Both learner and instructor (for iCube podcasts); instructor only (for pre- and postcasts) | Miller (2006; 2007); Sener (2007c) |
| Bentley College                  | USA     | Students in an introductory information technology class work in pairs or groups and produce vodcasts to teach topics based on the course lecture materials to their peers. | Learner               | Frydenberg (2006)             |
| University of Leicester          | UK      | Electrical Engineering students make use of “profcasts,” material designed to support learning distinct from that which is facilitated through structured on-campus or e-learning processes alone. The professor began weekly profcasts to supplement online teaching through updated information and guidance on the weekly activities, and to motivate his students. | Instructor            | Edirisingha, Salmon, and Fothergill (2006) |
students by incorporating relevant news items, anecdotes, and jokes.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Country</th>
<th>Activity Description</th>
<th>Instructor/Contributor</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Leicester</td>
<td>UK</td>
<td>Podcasting is used to provide an orientation or advance organizer for upcoming class activities in chemistry</td>
<td>Instructor Woodward (2007)</td>
</tr>
<tr>
<td>University of Edinburgh</td>
<td>UK</td>
<td>Pre-lecture podcasts are used to provide advance exposure to topics in elementary Physics identified as being conceptually difficult</td>
<td>Instructor Aliotta, Bates, Brunton, and Stevens (2007)</td>
</tr>
<tr>
<td>Open University</td>
<td>UK</td>
<td>Students studying German and Spanish courses in distance education mode are using digital voice recorders and mini-camcorders to record interviews with other students and with native speakers, as well as to create audio-visual tours for sharing with their peers.</td>
<td>Learner Kukulska-Hulme (2005)</td>
</tr>
<tr>
<td>Osaka Jogakuin College</td>
<td>Japan</td>
<td>Students are interviewed by their professor, perform roles, and/or present their own creations, in contribution to the professor’s bilingual podcast feed and blog for those studying Japanese or English as a foreign language.</td>
<td>Both instructor and learner McCarty (2005b; 2006); Sener (2007b)</td>
</tr>
<tr>
<td>Matsuyama Shinonome College</td>
<td>Japan</td>
<td>Students from two East Asian cultures participate in a recorded discussion in which they are asked to explain five proverbs in English as well as in their native language.</td>
<td>Learner McCarty (2005a); Sener (2007b)</td>
</tr>
</tbody>
</table>

**Table 2.** Some applications of podcasting and MP3 devices in higher education that go beyond “lecturecasting”

Schlosser (2006) reminds us that “[t]he use of audio in education is not new, but is experiencing a renaissance fuelled by the ubiquity of portable audio players, broadband Internet, and software tools that allow the relatively easy creation and distribution of audio files” (sec. 2, para. 1). The authors believe the true potential of podcasting technology lies in its community-building value, and its use as a vehicle for disseminating learner-generated content. This view is echoed by Atkinson (2006), who agrees that podcasting has limited impact as a mere method of distribution. According to him, “The emerging developmental and research direction seems...to be learning through creating podcasts and similar, in contrast to learning from podcasts” (p. 21, emphasis in original).

**Using podcasting to support learner-generated content: Some examples**

The remainder of this paper describes in greater detail a subset of the educational podcasting applications from Table 2, that focus on the use of the technology to support learner-generated content. In addition, a number of ongoing projects in this area are outlined. Boettcher (2006) suggests that there is a need to carefully re-evaluate the role of content in courses. In particular, learner-generated content, or what she terms “student performance content,” is beginning to receive increased emphasis – In the current tertiary education climate, the value of textbooks is being questioned (Moore, 2003; Fink, 2005), and the open source and open content movements are beginning to receive significant levels of support and acceptance (Beshears, 2005; Massachusetts Institute of Technology, 2003). Sener (2007a) concurs, and maintains that a move towards student-generated content has the potential to change education for the better – for example by increasing student engagement, developing critical thinking skills and fostering a sense of community, while also resulting in products of lasting value to students individually, to other students, as well as to the wider community and society as a whole.

To support his course in General Psychology, University of Connecticut professor David B. Miller (2006) hosts weekly informal discussions with students following each week’s lectures. During these discussions, students...
are able to seek clarification on the course material and talk about it in greater depth, as well as to discuss issues not covered during the lecture. The discussions are recorded and made available to the rest of the class as a series of podcasts entitled iCube (Miller, 2007), which is an acronym for “Issues In Intro.” In this way, the podcasts are about course content rather than simply being recordings of the course content itself. The process of creating and participating in the discussions becomes a form of student-generated content creation – All students in the cohort are welcome to submit questions in advance of the discussion via email; these answers, as well as those asked by students who attend in person, are answered during the discussion.

In an earlier project also emphasizing student-generated content, second year undergraduate students at Charles Sturt University, Australia produced short, three to five-minute talkback radio-style podcasts for pre-class listening by first year students enrolled in a subject that the second year students had successfully completed in an earlier semester (Chan & Lee, 2005; Lee, Chan & McLoughlin, 2006). The scripting, editing, and recording of the podcasts was driven by the student producers, with minimal instructor intervention in the process. The exercise was designed to benefit both the listeners, by alleviating their pre-class anxiety and allaying their concerns about issues such as assessment, thereby boosting their motivation and confidence, as well as the producers, for whom the intended outcomes were to develop a range of technical competencies, foster generic attributes such as teamwork and presentation skills, and express and conceptualize their understanding of previously learned subject matter.

At Bentley College, USA, Information Technology (IT) students enrolled in Mark Frydenberg’s (2006) IT Intensive course purchase Pocket PCs instead of textbooks, which they use to explore technology concepts in a hands-on, learner-centered approach. As part of the course, they from pairs or groups and work together to plan and produce podcasts. Each group produces a vodcast on one of the topics in the course schedule, for sharing with the rest of the class. This may be viewed as a novel form of peer and reciprocal teaching, and serves a dual purpose: In the process, students not only display their understanding of the course topics through the production of content for their peers, but also develop and exercise IT skills multimedia and Web technology that are directly linked to the objectives of the course.

In 2007, undergraduate students studying first year (freshman) level introductory IT subjects at Charles Sturt University and Bentley College are involved in a cross-continental, cross-institutional project, in which they are working collaboratively in groups consisting of a mixture of students from each institution. Each group is given the task of producing a 3 to 5-minute podcast, to be recorded over Skype (i.e. a “Skypecast”), in which group members discuss issues of relevance to topics that are common to the curricula at both institutions (Lee, Chan, & Frydenberg, forthcoming, 2007). The students must overcome issues related to cross-cultural communication, as well as challenges that arise from working with team members whom they are unable to meet face-to-face, across disparate time zones.

Other innovative applications of podcasting involving learner-generated content hail from the English as a Foreign Language (EFL) domain. According to Professor Steve McCarty of Osaka Jogakuin College, “In EFL, content creation also makes [students] part of the target language community, not just passive recipients or spectators of a foreign culture, which benefits their motivation and development of a bilingual identity” (McCarty, n.d., cited in Sener, 2007b, sec. 2, para. 1). While teaching an intensive course on translation at Matsuyama Shinonome College, McCarty (2005a) invited two Chinese and two Japanese students to participate in a discussion that was recorded as a podcast. The students were asked to each explain five given proverbs, in English as well as in their native language, as part of an attempt to explore if there was a similar way of thinking in the three cultures. The proverbs were: 1) Actions speak louder than words; 2) Advice when most needed is least heeded; 3) Look before you leap; 4) Penny wise, pound foolish; and 5) Ignorance is bliss. McCarty also maintains his own publicly-accessible, bilingual podcast feed and blog, Japancasting (McCarty, 2006), targeted at those studying either Japanese or English as a foreign language. The podcast episodes cover Japanese culture, history, folklore, and comparative religions, as well as contemporary social issues such as the education system and the rights of minorities (e.g. foreigners) in Japan. In many of the podcasts, students at Osaka Jogakuin College participate as voice actors or interviewees, and in some cases present their own creative work/scripts. Although they remain anonymous, the students are excited and motivated by the prospect of broadcasting to a worldwide, Internet audience (McCarty, 2005b; Sener, 2007b).
The roles of content consumer and producer need not be mutually exclusive: Lee (2006) proposes the use of podcast-enhanced collaborative blogs to allow students to share their oral presentations with their instructor and peers, as well as acting as a vehicle for feedback and peer evaluation. In a literature class on US fiction led by Peter Schmidt at Swathmore College, students were assigned the task of creating a “podcast pair” consisting of a five-minute reading of a chosen passage from a novel, coupled with a five-minute discussion of the passage and its relationship to other material. All students in the class were required to download and listen to selected podcasts by their classmates on what they were reading, prior to attending face-to-face class discussions (Evans, 2006).

Other than the above, there appear to be few documented examples of podcasting being used to support student-generated content in university teaching and learning. Perhaps tertiary educators and institutions can learn from the K-12 sector, in which “podcasts are being created mainly as experiential, authentic, group based constructivist learning experiences” (Atkinson, 2006, p. 21). Room 208 (Sprankles, 2005; Apple Computer, n.d.) is an excellent example in which third and fourth grade students work together to produce blog postings and podcasts on topics of their choosing, to share significant insights and activities with an Internet audience. The strategy has proved extremely successful in exciting, engaging, and motivating students to read, write, and do research, while honing their oral presentation skills. The students offer constructive criticism to one another, thereby engaging in collaborative learning. Crawford, Smith, and Smith (2005) outline two in-progress case studies involving podcasting within elementary school settings, which provide an excellent contrast between learner-centred and teacher-centered uses of the technology. The first case study involves the introduction of podcasts into a fourth grade Language Arts/Reading class. The students develop their own audio and video podcast presentations to share their poetry and creative writing works with the rest of the school community through their school-wide televised news program. In the second case study, a fourth grade mathematics teacher develops audio and video podcasts, as well as accompanying text and graphics files, with the primary aim of providing online, just-in-time homework support. New content is made available via the Internet each night to enhance the students’ understanding of their homework assignments and support them during their homework period, as well as to aid their parents’ understanding of the materials and homework expectations.

Conclusion

The pedagogic applications described in this paper are promising examples of how podcasting and other web technologies are moving away from didactic modes of teaching and transmission of content, to enable greater learner agency in the learning process, increased recognition that learner-generated content is a form of knowledge creation, and the development of peer-to-peer learning. This is very much in line with the Web 2.0 (O’Reilly, 2005) movement, which emphasizes collaboration, connectivity and the creation and sharing of “user-generated content” (UGC) in the form of social media or “we media” (McFedries, 2007).

While is not tantamount to declaring that digital audio will replace listening to live lectures or reading, podcasting can augment these forms of activity, while increasing the portability and accessibility of learning resources for learning “on the go.”

References

Aliotta, M., Bates, S., Brunton, K., & Stevens, A. (2007). Assessing the impact and potential of podcasts as pre-lectures. Unpublished manuscript.


