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Podcasting syndication services and university students: Why don't they subscribe?

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ABSTRACT

Partly owing to the status of podcasting as a buzzword and subject of much recent media attention, educational technology researchers and practitioners have been using the term very loosely. Few studies have examined student perceptions and uptake of “podcasting” in the true sense of the word, whereby a syndication protocol such as Really Simple Syndication (RSS) is used to allow students to subscribe to podcast feeds or channels, facilitating the automatic download of new content as it becomes available. The small number of studies that have covered this aspect of podcasting suggest that students generally do not tend to make use of this functionality, but instead prefer to simply download the media files manually. By drawing on research into the usage of RSS and podcasting both inside and outside the field of education, as well as extant literature on university students' usage patterns and behaviors with respect to information and communications technologies (ICTs) and the Internet, the authors postulate a number of possible reasons why podcasting syndication services have not experienced substantial levels of uptake among students to date. They argue that it is premature to dismiss RSS as a distribution mechanism for digital audio content in teaching and learning, and describe a number of examples of educational applications that could potentially make the use of such services worthwhile and valuable to both teachers and students. The authors conclude with suggestions for research to test the theories set forth in the article.

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1. Introduction

The editors of the New Oxford American Dictionary declared “podcasting” the “Word of the Year” for 2005 (Oxford University Press, 2005; Skiba, 2006); 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, which has resulted in a situation whereby many tend to use this term extremely loosely to refer to MP3-based audio recordings. 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.

Much emphasis is being placed on the third point above, i.e. the mobility aspect, perhaps due to the association between “podcasting” and Apple's popular MP3 player, the *iPod*. 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 device. The subscription-based download of podcast media files, despite receiving a comparatively underwhelming level of attention, holds much promise for the distribution of both instructor and learner-generated content. Podcasting subscription is made possible by XML-based syndication protocols such as Really Simple Syndication (RSS, also referred to as “Rich Site Summary”), Outline Processor Markup Language (OPML), or Atom, which were originally designed to facilitate the syndication of text summaries of additions to frequently updated websites, such as news sites, but which now permit the syndication of various media (MIME) types. For example, RSS 2.0 (RSS Advisory Board, 2005) 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. RSS and podcasting have much to offer in the way of simplicity, convenience and time savings for students since they do not have to manually plough through a plethora of sites for relevant content; nor is there a need for the even more tedious process of continually monitoring these sites for updates. As new enclosures

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become available on subscribed feeds, the files they refer to are automatically downloaded, with no user intervention. By having a computer continuously online, bandwidth-intensive content can be “dripped in” and made available when ready, so that the “click and wait” situation common in streaming is effectively eliminated (Curry, 2004), even in bandwidth-constrained environments.

2. Podcasting syndication services in education: a systematic literature review

2.1. “What’s new” about educational podcasting?

While educational podcasting is enjoying a continually growing level of interest and uptake internationally, there is a paucity of hard evidence attesting to its benefits. Much of the literature advocating the use of podcasting in teaching and learning is rhetorical in nature; there is certainly no shortage of material on how to make a podcast (Lunt, 2005; Jobbings, 2005), and plenty of enthusiasm for using podcasts in myriad facets of society (Pollock, 2006; Skiba, 2006). There are few studies that systematically evaluate podcasting applications in terms of the actual learning benefits afforded to students, while others appear to give little or no regard to past research conducted into audio-based educational technologies. 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 educational benefits of podcasting as evident in the literature (and the media rhetoric) may be categorized as follows:

1. The psycho-acoustic benefits of audio as a teaching and learning medium, from both a cognitive and affective standpoint;
2. Low-cost, low-barrier content creation and distribution, due largely to the pervasiveness of the Internet and the widespread availability of multimedia hardware and software;
3. Benefits afforded by time-shifted syndication and automated downloads through RSS;
4. Opportunities for mobile learning, thanks to the ubiquity and social acceptance of portable MP3-capable devices.

Audio-based educational technologies have been used for many decades, so the first point above is not new or novel in any way. Radio has been used in education for a variety of purposes. Audio cassette tapes, and more recently, CDs, have been used as a solution where the ephemeral nature and fixed transmission times characteristic of radio broadcasts pose a problem, where the audience is geographically distributed over too large an area, or where radio air time is not readily available. Much about educational podcasting can be learned from an examination of the vast literature available on the educational uses of these more mature technologies.

The last point above has been the subject of much recent attention and hype, notwithstanding the fact that for many years, we have had the ability to use devices such as the *Walkman* and *Discman* for essentially what is now very loosely referred to as “mobile learning.” Portable MP3-capable devices represent a technological advance over their predecessors in terms of their decreasing weights and sizes, their

growing in-built storage capacities, and their ability to accommodate rich digital content; however, as previously mentioned, most podcast downloads never make it to a portable player or another device – they are consumed on a PC, or perhaps never listened to. Specifically within the higher education sector, research in Australia at Charles Sturt University (Lee, Chan, & McLoughlin, 2006; Lee & Chan, 2007), the University of Ballarat (Newnham & Miller, 2007), and the University of New England (Tynan & Colbran, 2006), as well as in the UK at the University of Southampton (Copley, 2007), the University of Leicester (Edirisingha & Salmon, 2007), and Brunel Business School (Evans, 2008), to name a few, suggests that learners prefer to listen to podcasts on their desktop/laptop computer, at home, and set aside dedicated time to do so.

The authors believe that the second and third benefits in the numbered list above are what will have a lasting impact that will far outlast the shelf life of podcasting as a product of educational fashion. The present article focuses on the second point, i.e. the educational benefits of podcasting syndication services. In relation to the third point, the technology makes it simple for both teachers and learners to author and share rich media content quickly and easily. At a time when the value of textbooks and other “authoritative” sources of information are being questioned (Fink, 2005), and when the open source and open content movements are gaining increased momentum (Beshears, 2005), the authors believe the potential of digital audio technology in higher education lies not in the didactic uses of the technology, but rather in its community-building value, and its use as a vehicle for promoting learner-created content. Moreover, the reality is that today’s student “audience” is very much in control of the content found online and are no longer passive consumers of knowledge but also producers, or “prosumers,” indicating a more active approach to learning (Klamma, Cao, & Spaniol, 2007).

2.2. Educational podcasting research: a survey of the present landscape

If there is a lack of literature containing empirical evidence of the impact and effectiveness of educational podcasting, an even smaller subset of the literature published to date reports on studies that have covered the syndication services aspects. Table 1 summarizes the outcomes of a meta-analysis, in which an extensive literature search was conducted to locate empirical research studies in the field of educational podcasting within the higher education sector internationally. The identified studies were examined and coded according to their degree of emphasis on the syndication/subscription aspects of podcasting. In this case, two of the authors undertook the classification task independently, then compared their results in the interest of inter-rater reliability. A majority of the studies were found to allude to syndication/subscription services in their definition of podcasting, but either did not provide this facility to students, or did not report on students’ uptake/use of this facility. Of the 10 studies that fell into the fourth category, i.e. those that included data about student uptake/use of syndication/subscription services, 3 provided data on students’ *actual* use of RSS as determined through server logs and 7 relied on their *reported* use of RSS (elicited primarily through surveys/questionnaires). It should also be noted that the meta-analysis excluded studies that solely measured students’

Table 1
Summary of meta-analysis of empirical studies on educational podcasting

Category	No. of studies in this category	%
1. Ignores / does not mention RSS at all	5	12.20
2. Mentions or alludes to RSS, but RSS was not made available to students (or it is unclear if RSS was made available)	14	34.15
3. RSS was made available to students, but the publication(s) do(es) not include any data on student uptake/use of RSS	12	29.27
4. Reports data on student uptake/use of RSS	10	24.39
Total:	41	100.0

planned or intended use of podcasts and podcasting syndication services, but did not collect data following the implementation of an actual podcasting exercise.

2.3. Uptake of subscription/syndication services

The published studies that do provide coverage of student use of subscription/syndication services generally report disappointingly low uptake levels of these services. They suggest that students do not tend to subscribe to RSS feeds, but instead prefer to simply download the media files manually. For example, [Atkinson, Buntine, and McCrohan \(2007\)](#) reported from RMIT University that only 4% of respondents subscribed to RSS feeds, in spite of 14% affirming the use of a portable audio device to listen to lecture podcasts. Although respondents agreed that subscribing to podcasts made them easier to obtain, [Lee and Chan \(2007\)](#) at Charles Sturt University found that only 27.78% of them actually subscribed to a feed used to distribute supplementary, talkback radio-style podcasts produced by a group of volunteer students who had previously completed the information technology subject the respondents were studying. Most respondents favored manually downloading the MP3 files via a web browser instead of taking advantage of the capabilities of RSS.

At the University of Portsmouth, [Maniar and Bennett \(2008\)](#) obtained similar results in a cross-faculty study, in which the lecturers in five different units recorded pre- and post-lecture podcasts to supplement their face-to-face teaching. 22% of the respondents (34 out of 144) subscribed to the podcast feed in their respective units, with a further 13% (18 out of 144) subscribing to the feed but reporting that they still tended to listen to the recordings online through the university's *WebCT* learning management system (LMS). 63% of the students (91 out of 144) did not subscribe.

One study that showed promise in terms of student uptake of subscription/syndication services was conducted at the University of Michigan (U-M) School of Dentistry ([Brittain, Glowacki, Van Ittersum, & Johnson, 2006](#)). Beginning in the first semester of 2004, the School requested that all lectures be videotaped and made available via the Web. Students doubted their note-taking skills in terms of their ability to accurately summarize the quantity of information presented in lectures reviewing a video recording of each lecture would aid them in retaining the information presented. In response to the students' requests, the Dental Informatics Group at U-M applied formative evaluation strategies incorporating interviews and focus groups, and subsequently determined that podcasting audio recordings of lecture recordings provided a better solution for the students' needs than the video recordings that were originally requested. The decision to adopt podcasting as a distribution method was in large part due to (p. 25):

- the routine and regular addition of new content; and
- the ability to automatically receive new content ... select[ed] through subscription.

RSS functionality was added to eliminate the need for students to for new files. Following this, server logs showed that 50 percent of files were downloaded via RSS.

2.4. The need for institutional support and infrastructure

The production of 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. These successes may indicate that while a podcast is not difficult to produce, the provision of large numbers of subscription-based podcasts may be the stumbling block for many educational podcasters. The syndication process may be beyond many academics from a technical or workload perspective, and institutional commitment, endorsement, or infrastructure may be lacking. This would go a long way towards explaining the reluctance of educational podcasters to use the syndication feature that so defines podcasting in the true sense of the term.

3. Possible reasons why students may not use podcasting syndication services

The authors believe that the tendency of students and educators not to take advantage of the capabilities of podcasting subscription/syndication services may be attributed to a number of factors, although further research must be undertaken to ascertain the precise reasons why this has been the case. Firstly, there appears to be a lack of technical knowledge among students and teachers. They may not be fully aware of the capabilities of RSS and the possibilities it presents for the distribution of audio content, a situation that is not being helped by the proliferation of the term "podcast" as used to refer to any digital recording of a radio broadcast or similar program that is made available for downloading via the Internet and able to be consumed on a portable audio player. A survey of over 1,300 Americans conducted by Pew Internet & American Life Project revealed that only 9% of Internet users knew of RSS feeds and understood the possibilities that they presented ([Rainie, 2005](#)). This statistic was only slightly higher for young adults, with 12% of U.S. Internet users ages 18 to 29 possessing a working knowledge of what the term RSS means. Interestingly, the study found that a higher number of respondents overall (13%) understood the term "podcasting."

Secondly, students may have fixed habits and patterns/behaviors in terms of the way that they access the Internet and browse the Web. The model on which "Web 1.0" operates requires users to manually visit and search through web sites to find the content that they require. This stands in contrast to the publish/subscribe model of RSS, which heralds a paradigmatic shift from producer push to demand pull (cf. [Hagel & Seely-Brown, 2005](#); [Dieu & Stevens, 2007](#)). Even with the diversity found in today's university students, many of the technologies used by students cannot be considered uniform and universal, according to [Kennedy, Judd, Churchward, Gray, and Krause \(2008\)](#). They point out in their study that the use of RSS feeds is perhaps premature for a student population not as digitally "native" as [Prensky \(2001\)](#) argued.

Although not specific to podcasting, [Glottbach, Mohler, and Radwan \(2007a\)](#) describe a study in which RSS was used as a delivery method to deliver course announcements to approximately 240 students studying a 100-level course at Purdue University entitled *Internet Foundations, Technologies, and Development*. At the start of the semester, the students were given a short introduction to RSS, at which time it was determined that a majority of them had no previous knowledge of what a RSS feed was, despite the fact that many of them were majoring in an area within the computing and information technology discipline. Comparisons between initial and end-of-semester surveys revealed that at the conclusion of the course, participants showed an increased knowledge in RSS, with the number of respondents who indicated that they understood the potential offerings of RSS increasing from 39% to 75%. Contrary to these results, however, the minimum weekly usage reported by respondents increased only marginally from 27% to 30% between the initial

survey and the final survey, demonstrating that students remained hesitant to adopt this technology as part of their daily online routine or regiment.

Several authors (for example, D'Souza, 2006; Harrsch, 2003; EDUCAUSE, 2007; Glotzbach & Mohler, 2006; Glotzbach, Mohler, & Radwan, 2007b; Duffy & Bruns, 2006; Dieu & Stevens, 2007) have written about the educational uses and benefits of RSS in general. EDUCAUSE (2007) reminds us that although RSS is "[an] excellent mechanism for distributing regularly updated content" (p. 1, para. 5), "[n]ot all content is appropriate for RSS, such as a published article that is not going to change" (p. 2, para. 6). A third possible explanation for the low uptake of podcasting subscription among students is that educators seem to be using the technology to distribute relatively small amounts of largely static content over a single feed/source at fairly consistent intervals (e.g. weekly lectures in a single course or unit of study), as opposed to voluminous amounts of dynamic, time-sensitive content across multiple feeds in a sporadic fashion. Many studies point to a small infusion of podcasts into one unit or for a restricted period of time. When a critical mass of podcasting is reached within the curricula, students may find it more worthwhile. There does not yet appear to be a major incentive or need to take up RSS from the student's point of view, as the potential time savings to be gained from avoiding the need to check for and download new content manually may not seem to be worth the overhead required to set up an aggregator, and/or the need to maintain a continuous connection to the Internet. In the U-M study (Brittain, Glowacki, Van Ittersum, & Johnson, 2006) discussed in the previous section, a critical mass appears to have been reached, as there were a number of podcasts with episodes spanning several courses. This would have made keeping up with the podcasts without the subscription feature difficult and time-consuming. Conversely, in the aforementioned Purdue University study (Glotzbach, Mohler, & Radwan, 2007a), the researchers suggested that the low uptake could be due to the lack of activity on the RSS feed, as only a limited number of announcements were posted throughout the duration of the course. They predicted that there would be a positive correlation between the frequency and number of announcements and the number of students who use the RSS feed, but at the time of writing their paper they had yet to collect data to substantiate this claim. Koo and Kwong (2006), also from Purdue University, studied the subscription behavior of students with respect to the BoilerCast, a university-wide service that delivers audio classroom recordings to students via podcasting. They anticipated that when more classes podcast their lectures, students who had not previously subscribed to the service would begin to do so.

A final possibility is that it may simply be that students make use of a variety of computers to access the web, for example, on-campus at university, as opposed to strictly using their own personal computer, and so elect not to configure an RSS aggregator program to download podcast files to a single system. This may change with the advent and growing popularity of web-based aggregators such as *Netvibes*, *Google Reader*, and *Bloglines*, which are based on server-side aggregation, meaning that feeds are periodically polled and content downloaded to a server on a regular basis. Users carry out the tasks of subscribing to feeds as well as consuming feed content (including listening to podcasts) via a web portal, which provides them with the ability to access their feeds using a web browser from any Internet-connected computer, not just the computer on which they have installed a particular client-side aggregator application.

4. Towards pedagogically sound and useful applications of podcasting syndication services

There is no doubt that large numbers of students have access to and are already making use of the information and communications technologies (ICTs) necessary for podcasting syndication services to be a valuable tool in future. Studies of student technology use conducted

in the United States and Australia (Kennedy, Judd, Churchward, Gray, & Krause, 2008; Oliver & Goerke, 2007; Salaway, Caruso, & Nelson, 2007; Oblinger & Oblinger, 2005) in recent years report high levels of usage of devices such as laptops, mobile phones, and MP3 playback devices, as well as of the Internet. For example, in a study involving 103 institutions across the U.S., Salaway et al. (2007) found that 73.7% of students owned laptops, nearly 100% owned mobile phones or smartphones, and 76.4% owned MP3 players. Oliver and Goerke (2007) found similar numbers at a major university in Western Australia, with close to half of first year undergraduates owning a laptop, 96.4% owning a mobile phone, and over 69% owning an MP3 playback device. They argue that as university staff come up to speed with technologies that can assist in teaching, students are likely to become more engaged in the learning process. They also specifically cite RSS syndication as a technology that presents many advantages for users, and one that lecturers should strongly consider adopting.

Currently, most uses of podcasting in higher education (e.g., recorded lectures) replicate traditional behaviorist models of teaching and learning, based on didactic and transmission-oriented approaches whereby it is the teacher's responsibility to transfer or impart knowledge to students. By contrast, in the epistemology of social constructivism (Vygotsky, 1962; Berger & Luckmann, 1966; Searle, 1995; Kukla, 2000), it is argued that knowledge and reality are actively created in the minds of learners as a result of their participation in social relationships and interactions. The teacher's role is that of a partner or collaborator in the knowledge construction process. The teacher and student both engage equally in the tasks of description, explanation, understanding, reflection, and disclosure. Furthermore, the interactions occur not only between teachers and students, but also among students in peer-to-peer relationships (Derry, 1999). Through syndication technologies such as RSS, OPML, and Atom, content and knowledge developed by a student learning community can be publicized (syndicated) and distributed (aggregated). In this way, podcasting syndication may be seen as a collaborative tool that facilitates relationships between the pedagogy, the community members, the content they produce, as well as other web-based technologies.

Connectivism (Siemens, 2005) appears to be emerging as a new educational theory or approach that attempts to accord with our changing information environment in the 21st century. Connectivism takes social constructivism a step further, viewing the teacher as having the role of a mediator. The key idea is that learning starts with the connections that students make with one another, as opposed to with a fixed body of content. Siemens (ibid., p. 7) articulates eight major principles of connectivism:

1. Learning and knowledge rests in diversity of opinions;
2. Learning is a process of connecting specialized nodes or information sources;
3. Learning may reside in non-human appliances;
4. The capacity to know more is more critical than what is currently known;
5. Nurturing and maintaining connections is needed to facilitate continual learning;
6. The ability to see connections between fields, ideas, and concepts is a core skill;
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities; and
8. Decision making is in itself a learning process; choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality; while there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Podcasting and podcasting syndication services, as well as other Web 2.0 technologies such as blogs, wikis, social networking, and peer-to-peer media sharing, have the potential to support complex, many-to-many connections in line with this philosophy. The ability to

organize and share user-created content with speed and simplicity, combined with the possibility of capitalizing on the new wave of mobile and ubiquitous computing tools to do so anytime, anyplace, and on any device, provides fertile opportunities for the types of community-based learning advocated by the abovementioned theories. Campbell (2005) echoes this view:

...[P]odcasting is less like a web and more like the spokes of a wheel. There may be many or few spokes radiating from the podcast, but the connections are essentially one-to-one, no matter how many listeners [there] are...[This] kind of direct personal connection...[can be] scaled to encompass a large and diverse audience...(p. 44)

Outlined below are a number of examples of applications, underpinned by social constructivism and connectivism, that could potentially make use of podcasting syndication services worthwhile and valuable to teachers and students:

Example 1: *Peer-to-peer sharing of student-generated learning objects:*

Student-generated content is beginning to receive increased emphasis in a higher education climate where, as alluded to earlier, the value of textbooks is being questioned, and the open source and open content movements are beginning to receive significant levels of support and acceptance. Garrett and Nantz (2006) provide an impetus for the creation of distributed learning object syndication networks, in which all participants both produce and consume reusable learning objects (RLOs). According to them, students participating in these networks become adept at creating and moving content and filtering and receiving information, and the new communication paradigm encourages them to view information from a fresh perspective. Such practices exemplify the expressions “user-generated content,” “users add value,” and “peers produce knowledge,” which are all reminders that with the help of supporting tools, appropriate learning activities can draw on the participants and their knowledge, enabling collaboration and the creation of shared artifacts. This collective knowledge building and sharing is what the Web 2.0 movement, which podcasting and RSS form part of, is all about.

From a practical point of view, if implemented on a large scale (for example, in large cohorts, or cohorts consisting of many class groups/sections), the benefits of using syndication technology in such contexts become apparent, since content is likely to be produced and released in chaotic, or at best, erratic, patterns, and could be spread across numerous feeds or sources. RSS provides a mechanism by which peer-to-peer content can be “pulled together” from multiple sources, filtered, and organized so that the student need only attend to the learning objects that are of interest and/or relevance to him/her, as opposed to having to systematically consume a large number of items (e.g. numerous podcast episodes or segments), or items that are large in size (e.g. lengthy podcasts) to reach the content he/she needs. Of further noteworthiness is the fact that RSS was originally designed to enable the delivery of summaries of text-based Web content; thus, headlines and short paragraphs of synopsis or “teaser” text can be easily included in a podcast feed to help learners decide whether or not they wish to proceed to listen to each segment or episode.

Example 2: *Podcasting to support authentic learning and assessment:* The use of podcasting and RSS presents exciting prospects for authentic learning and assessment directly linked to and/or

situated within students' employment or fieldwork contexts. The multimedia capabilities of modern portable devices can be used to deliver text, audio, images, and video to members of a distributed workforce in small, “bite-sized” pieces for just-in-time learning, such as in preparation for a real task in the workplace. In addition to voice, students can capture and disseminate “student performance content” (Boettcher, 2006) in the form of images (enhanced podcasts) and video (vodcasts) in authentic settings to be shared with their peers and instructors through RSS, and receive assistance with and feedback on job tasks through opportunities for observation, correction, and remediation.

RSS and other syndication services provide rich opportunities to enable the building of communities of practice that transcend the walls of the classroom or institution. For example, McLoughlin, Brady, Lee, and Russell (2007) describe a project in which podcasting was used to support peer mentoring of pre-service teachers during their school-based teaching practicum, and to allow them to interact with one another through the sharing of experiences, stories, and anecdotes. In this way, both teachers and students can become active “prosumers” of asynchronous, voice-based discourse in an online community of practice. Such activities can become unwieldy or cumbersome for participants, given the given the copious volumes of multimedia content involved and the sporadic and unpredictable manner in which new material is generated. With the aid of syndication technologies like RSS, the complexity of receiving and organizing content is significantly reduced, enabling students and teachers to focus on more pertinent tasks such as self-assessment, reflection, and providing feedback and critique to others.

Example 3: *RSS and podcasts for personalized learning:* A Personal Learning Environment (PLE) (Attwell, 2006, 2007) may be broadly defined as a learning environment in which learners manage their own learning using various software and services. In contrast to an institutionally-controlled LMS, a PLE provides contextually appropriate toolsets by enabling individuals to adjust and select options based on their needs and circumstances – resulting in (ideally) a model where learner needs, not technologies, drive the learning process. In the PLE model: “[an] ... e-learning application ... represents one node in a web of content, connected to other nodes and content creation services used by other students ... content is reused and remixed according to the student's own needs and interests” (Downes, 2005). This approach means that learning content is created and distributed in a very different manner to the traditional approach: Rather than being composed, organized, and packaged, e-learning content is syndicated. From there, it is re-mixed and repurposed with the student's own individual application in mind, the finished product being fed forward to form the raw material for other students' reading and use. In a PLE, a student is able to customize, control, and shape his/her own learning landscape, integrating multiple RSS feeds to allow for the aggregation of a range of multimedia content not limited to podcasts – For example, the audio material may be intermingled with text from blog entries, images, videos (vodcasts), animations, SlideShare presentations, and so on. Podcast and other RSS feeds may be offered at varying levels of granularity, thereby further enhancing learner choice and flexibility in specifying what content they wish to receive in their PLE to suit their particular needs and interests. For example, a university might offer a feed

at the institution level to disseminate information pertaining to the university as a whole; separate feeds might be established for each faculty, department, or discipline, and by academics, researchers, and students within these organizational units. Furthermore, a student's PLE may include subscriptions to a variety of feeds outside the institution at which he/she is formally enrolled, allowing him/her to follow new and emerging trends and developments in his/her field of study, a key skill that university graduates will need to use in their professional lives. However, such approaches are not without their challenges, as they call for educators and institutions to relinquish some degree of control and to look beyond the traditional view of classroom authority. Moreover, Hilton (2006) describes the rise of the "pure property" view of ideas that may serve as an additional impediment to promoting the forms of open collaboration and sharing needed for such approaches to be successful.

5. Conclusions and recommendations for future research

A vast majority of reports of research and development in the educational uses of podcasting and RSS, and social software technologies in general, appear to be isolated, disconnected, and highly contextualized. Few are generalizable to a variety of institutions, academic disciplines, countries, cultures, and student audiences. While much can now be said about the potential advantages of podcasting for students, there is a need for empirical research that is longitudinal in nature and large scale, so that this still-nascent learning technology is able to move beyond its experimental stage and find its place within the university teacher's ICT repertoire. In particular, future studies should target the unique capabilities and features of podcasting that differentiate it from other older or pre-existing audio technologies. Specifically, despite the lack of significant reported uptake to date, the authors are not prepared to dismiss RSS as a distribution mechanism for digital audio content in teaching and learning. Existing uses of RSS in education do not fully exploit its capabilities to facilitate complex teacher-learner and learner-learner interactions, as well as to act as a catalyst for collaborative knowledge building, sharing, and exchange. "By enabling new channels of data exchange, as with research data and communities of learners, RSS has the potential to create a stronger connection between knowledge creation with individual learning" (EDUCAUSE, 2007, p. 2, para. 8).

Further work must be undertaken in order to reliably validate the reasons behind the tendency of students not to subscribe to podcast feeds. Additional research must interrogate whether these reasons lie with lack of availability or of student interest. The authors also believe that students' tendency not to download podcasts through subscription may also be a result of pre-established habits in the way they use the Internet and access web-based information. RSS, Atom, and other syndication/subscription services necessitate a change in the mindset of teachers and students. Over time, as Web 2.0 tools and applications become increasingly ubiquitous in both mainstream society and in education, these services may gradually become part of students' personal knowledge management toolkits. Kennedy et al. (2008) consider that the degree to which students are using many emerging Web 2.0 technologies, such as blogs and social networking, calls for further integration of these and other technologies into university curricula. This points to a future for the use of syndication services with podcasting and other technologies as they begin to attain critical mass at an institutional and sector level, and we arrive at a stage whereby there is a need for the delivery and organization of content and information through subscription. In the long run, students and educators will need to adopt a more sustainable and efficient way to filter and organize the vast and continually growing

volume of Web-based information. EDUCAUSE (2007) claims that "... [RSS] has the potential to become the primary vehicle through which users interact with the Internet" (p. 2, para. 4). In anticipation of and preparation for this, future studies in the field of educational podcasting should examine the correlations between volume and nature of content, and student uptake/use of RSS. For example, do the number, length, and frequency of podcast episodes within a course or unit of study, and the size of available podcast files both individually and collectively, have an effect on student uptake of syndication/subscription services? How about the type and purpose of the podcast content, and whether it is instructor or student generated? Last but not least, most podcasting implementations currently reported on in the literature are driven by individual academics or lecturers as opposed to being supported at an institutional level, and are therefore concerned solely with individualistic interest. It remains to be seen whether students will be more likely to subscribe as the number of feeds/sources available to them increases across courses, disciplines, and curricular areas, and whether they will effectively use such capabilities to support their academic studies, as well as to assist them in their life-wide and lifelong learning endeavors.

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