

## **PODCASTING IN HIGHER EDUCATION: MAJOR FACTORS THAT CONTRIBUTE TO ITS EFFECTIVE USE**

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### **Abstract**

Podcasting can serve as a primary delivery method for content in higher education. Often “how to...” reports do not offer an effective description of the possible applications that podcasting can bring to the classroom, because these reports often focus on how a single or several applications were used to meet their specific needs. The objective of this paper is to provide a general description of podcasting outlining the major characteristics that contribute to its effective use. A review of the history of podcasting and its current use in higher education, previous research on learning with audio, effective audio communication principles, and the selection of appropriate media were used as the basis to improve the reader’s understanding of the capabilities of this new technology. In order to identify the most important factors that contribute to the use of this technology, an analysis of two implementation reports at two major universities and interviews with experts in the field were conducted.

**KEY WORDS:** Podcasting, auditory learning, media selection, emerging technologies, and higher education courses

### **INTRODUCTION**

In recent years, the creation and development of podcasting has attracted the interest of higher education. Podcasting allows for the easy distribution of audio content through developing internet technologies and syndication methods. The Oxford English dictionary defines a podcast as “digital recording of a radio broadcast or similar program, made available on the Internet for downloading to a personal audio player” [Safire, 2005, par. 1]. Podcasting is a developing technology that was conceived in 2000. Professionals are still discovering the potentials of the technology.

Many institutions in higher education, before implementing podcasting projects, developed pilot programs addressing their specific needs and requirements. Unfortunately, these pilot programs cannot serve as best practice methods for all institutions because of the differences in budget and infrastructure between institutions. Therefore, a comprehensive description of the major factors that constitute effective use of podcasting in education is important.

The goal of this paper is to provide a description of podcasting and its integration in higher education and to serve as a guide to potential users of this technology. Another goal is also to help faculty identify the specific features of podcasting that can meet their needs, rather than to provide a vague definition or a “how to...” method that might not fit every individual institution.

## REVIEW OF THE LITERATURE

### PODCASTING IN HIGHER EDUCATION

The use of audio media in education is not new. Podcasting offers a simple approach for educators to embrace the use of this technology. The development of new internet capabilities that permit two-way communications between webpage developers and users created an efficient method for the distribution of audio content.

#### Podcasting Technology

In order to understand podcasting, it is important to consider the two technologies that together led to its development: blogs and RSS (Real Simple Syndication). Hargis and Wilson [2006] define a blog as a website made up of brief entries, updated regularly and posted in a chronological manner, similar to instant messaging. The technique enhances communication within small groups and it is easier to use than email and discussion boards.

RSS can stand for rich site summary or real simple syndication [Richardson, 2005]. Richardson [2005] describes RSS as a format for collecting web content in one place through the use of software called 'aggregators'. Aggregators collect information from sites based on subscription information similar to email, but without the common dangers of spam and viruses.

*Podcasting* is a combination of two words, "*pod*" from Apple's iPod digital music player and "*casting*" from broadcasting. It is an innovative way for the delivery of audio content that ranges from informational programs, interviews, to music [Fichter, 2006]. Hargis and Wilson [2006] explain that podcasting combines the use of blogs and RSS to allow content providers to use a feed to distribute content through aggregators. Aggregators download the content for current or future use allowing for a much simpler distribution of audio content than existed in the past. The process is based on its syndication functionality. Fichter [2006] explains that "Podcatchers", such as iTunes or iPodder, allow users to setup feeds similar to RSS aggregators that provide a brief description of the audio file, allow for automatic download of new podcasts based upon the subscription setup, and alert the user when new content is available.

#### Instructional Foundations of Podcasting

The benefits offered by podcasting technology have encouraged faculty and institutions to digitally record courses and classroom material and make them available for download [Fichter, 2006]. Faculty see podcasting as a way of improving interaction with students and providing alternative media for learning that is easier to use [Lum, 2006]. Hargis and Wilson [2006] indicate that podcasting offers different approaches for improving pedagogical foundations of information processing and conceptual learning.

Conceptual learning is a strategy used to transfer short term memory to long term memory. Podcasting uses some of the major strategies in conceptual learning to keep the learner engaged for long periods of time [Hargis & Wilson, 2006]. Some scenarios that showcase the pedagogy involved in podcasting may include broadcasting from a manufacturing site in an industrial engineering course or interviewing children while they participate in a field trip for pre-service teachers [Hargis and Wilson, 2006]. When the podcasts contain original background sounds, the learner may be able to visualize the content and as a result, better relate to the situation.

#### Developing Infrastructure

Implementation of podcasting in higher education has been the topic of several "how to..." articles describing the design and development of the necessary infrastructure to support and distribute course material. O'Toole [2006] argues that in higher education customization is necessary in order to achieve the success of an application that can deliver course content with the use of podcasts. But many institutions in higher education do not have the resources for developing their own programs for podcasting. Therefore, they turn to companies like Apple that provide services to meet the needs in developing and distributing podcasts. Stanford University, Duke University, Missouri School of Journalism, Penn State University, and Ohio State University collaborate in the 'Apple, Inc. Digital Campus Initiative' to investigate the impact of these technologies on learning. One specific effort of this

initiative is to share resources and best practices among educators using the many technologies offered by Apple, including podcasting [Apple Digital Campus, 2007].

Institutions that take advantage of the different software packages that Apple offers tend to focus on developing hardware infrastructure to create podcasts rather than to deliver it. The University of California, Davis is a good example of an institution that developed hardware infrastructure to support the implementation of podcasting. The University installed audio recording equipment in different halls across campus. To enable students to record courses which were not distributed through podcasts, the University provided portable digital recorders on a loan-basis [UC Davis Podcasts, 2007].

Apple is not the only company offering podcasting services. *Tegrity*, a leader in recording of classroom content, and *Blackboard*, the leader in e-learning platforms, have joined forces to provide a service that will allow the capture and delivery of every course offered at an institution. The courses will be indexed and available for download through the Blackboard platform [Blackboard Media Center, 2006].

### Coursecasting

Podcasting permits faculty to embrace the notion of digitally recorded course content and lectures [Fichter, 2006]. Allowing for the portability of courses, or "coursecasting," may assist students who fall behind in courses or/and provide additional help to English language learners [Read, 2005]. Advocates of coursecasting view this technology as more than just a tool for review; they see it as a supplement to the classroom that can improve interaction with students [Read, 2005]. Gaugler, a Mansfield University professor, suggests that podcasting should be viewed as a way to enhance student interaction [Lum, 2006]. Chan and Lee [2006] recommend that faculty should take advantage of this technology as it has tremendous appeal with students who may be impatient with traditional ways of learning. A major advantage of podcasting is that it not only supports the capture and delivery of lectures, but can also be used to distribute information that can alleviate some of the concerns of students [The California State University, 2006]. For example, Charles Stuart University uses podcasting technology to distribute information to students and to minimize their anxiety as they prepare for class (Chan & Lee, 2006). Brittain, Glowacki, Van Ittersum, and Johnson [2006] describe a pilot program at a school of dentistry where podcasting was used by students to compare notes. Lum [2006] indicates that at Purdue University courses are recorded and made available to students at the college library. Fitchburg State College uses podcasting to distribute acceptance messages to incoming freshmen. The new students receive an email that directs them to a podcast that contains a welcome speech of the college president [McCafferty, 2002].

With all the noted advantages of this technology, there are also concerns. Foremost among them is the fear that this technology might serve as an excuse for students to skip classes [Read, 2005]. In addition, there are serious concerns about the intellectual property rights of faculty members and their lectures. Read [2005] states that access to intellectual values beyond the classroom should be protected.

### Podcast Design

In order for a podcast to be effective, it is important for the designer to establish the context for the final product. For example, course content and learner characteristics differ between undergraduate and graduate courses and, therefore, impact on the context. Lengel [2006], states that a podcast needs to be in a context familiar to the target audience. For example, people listen to music recordings on average for four minute. It is possible for this time to increase while engaging in activities such as jogging or traveling long distances. Determining which length of listening time is a common representation of the target audience may help a designer develop the style and content of an effective podcast [Lengel, 2006].

When developing a podcast, a designer should consider several factors. Lengel [2006] suggests that faculty should not just transfer their current lecture content to a podcast, but explore how they could place their lectures in a context that is familiar to their target audience. There is no magic length for the ideal podcast; instead, context and the characteristics of the target audience should determine the length.

In the design of a podcast, the file format is an important part of the final product. There are different formats for encoding audio. Matthews [2006] indicates that the mp3 format is best suited for podcasting because it allows the user to transfer the file to different devices. Converting files to mp3 format ensures the ease of use and portability of podcasts. Software, such as GarageBand for Macintosh and Sound Recorder for Windows, allows for the compression of audio into mp3 format [Matthews, 2006].

### Accessibility for Users with Disabilities

Easy access to users with disabilities should be an important factor in the design and delivery of a podcast. A designer not only needs to take the learning needs of the target audience into account, but must also accommodate access to students with disabilities. All federally and state funded institutions must meet strict standards in this regard. The United States Access Board, an independent federal agency, is charged with ensuring accessibility, and through *Section 508* provides specific guidelines and standards for the architecture, communication and transportation of media [United States Access Board].

### **AUDIO AS LEARNING MEDIUM**

Due to a commonly held view that listening to audio is not learning, audio has been one of the most underused media in education [Chan & Lee, 2006]. However, current perception differs and considers listening as an efficient and instinctual skill that has many advantages over non-instinctual skills such as reading and writing. The spoken words may influence cognition and motivation and provide subtle nuances that can stimulate the auditory senses [Chan & Lee, 2006]. In education, audio is a good medium to transmit information that is oral in nature such as interviews, commentary, and verbal interaction [Johnston, 1987]. One example of an application of audio as learning media is self-paced verbal instruction in which a student can go back and repeat instruction as necessary [Heinich, 1982].

### Developing Effective Audio Media

First, it is important to take into account that the quality of audio messages is directly affected by the ability of the sender to express the message clearly and logically [Heinich, 1982]. Kiefer [1965] explains that, for a recording to be effective, "it must, present a limited number of teaching points, be concrete, lucid, present a lively style, provide illustrations of principles or abstract points, and contain clear summaries." Brown, Lewis, and Harclerod [1967] provide the following six step process important for using audio in education:

- instructors/designers prepare themselves,
- develop student readiness,
- listen to the program,
- follow up the program with some type of post listening discussion,
- listen critically, and
- listen for appreciation.

Although identifying the different processes in audio design is useful, specific guidelines provide a clear view of this process and can assist the designer in the development of an effective product.

Theroux [1978] provides the following guidelines for effective audio design based on research and experience. They include suggestions for the overall objective of audio design, the speaker, recording techniques, and pedagogical design. These guidelines consist of satisfying audience needs, anticipating the responsiveness of an audience to a topic, providing realism and credibility in recording, targeting a local audience, and using familiar sounds to get attention of the audience. A recording should not be more than fifteen minutes to keep the attention of the audience and must be of interest to the audience in order to influence learning. Finally, the format of an interview, a lecture, or an entertainment show, of a recording, is crucial. The format chosen should fit the characteristics of the target audience [Theroux, 1978].

### Advantages and Disadvantages

Delivery of instruction through the use of audio has many advantages. Audio is cheap and easy to produce, and the wide availability of playback components makes it a great delivery model for instruction [Chan & Lee, 2005]. An important aspect of audio is that it captures the emotiveness of the human voice, an important attribute to the persuasion of the listener. It can also capture argument and important verbal features [Johnston, 1987]. If audio is used effectively as a delivery method for content, it may free the lecturer to complete other tasks during time allotted for classroom instruction [Romiszowski, 1988]. Romiszowski explains that pre-recording lectures will provide a better prepared presentation as it allows the professor to edit, revise, and organize the lecture.

Although the use of audio in education has many advantages, it has disadvantages as well. Chan and Lee [2005] indicate that "the shortcomings of audio appear to be in the area of providing complex and/or

detailed information that needs to be heavily processed, logically deconstructed, committed to memory, or otherwise requires a great deal of concentration [pg. 64].” Another disadvantage is that audio does not only depend on the quality created by the sender, but is also affected by the ability of the receiver to decode any messages [Heinich, 1982]. Moreover, audio does not provide the flexibility of a conventional presentation [Romiszowski, 1988].

### Audio Design Principles

Learning with audio requires that effective techniques be used to produce quality audio that facilitates learning. The following audio design principles may be beneficial in a recording process:

- Write for listening, not reading. Speak words before finally scripting them.
- Avoid complex sentences and use familiar words.
- Employ short phrases that will give the listener time to comprehend and synthesize the material.
- An informal conversational style is best. Use the direct “you”.
- Avoid any wording that would cause the narrator to falter.
- Be sure to choose a credible narrator and one who is appropriate for the audience.
- Two or more voices add variety and can increase attention and interest.
- The delivery rate must be suitable to the audience and the subject matter [a typical rate of delivery is about 180 words per minute].
- Be sure the narrator uses correct pronunciation and emphasis.
- Choose suitable music.
- Avoid any musical score that might compete with the narration.
- Use sound effects to create realism and to add interest and emphasis. Be certain they are realistic and that they are employed judiciously.
- Vary the tone of delivery and the style of conversation.
- Encourage active listening and participation by posing questions, problems, etc.
- Break the recording into short 1-3 minute sections, building in summaries, pauses and occasionally stops for audience participation [Romiszowski, 1988, page 183].

## **AUDIO COMMUNICATION**

Heinich [1982] describes communication as the transfer of information from a source to a destination. He defines instruction as the arrangement of information to produce learning. Important aspects of communication through audio are listening skills and learner’s motivation.

Heinich [1982] identifies the following techniques for improving listening skills;

- Directed listening
- Following directions,
- Listening for main ideas, details, or interferences,
- Using context in listening,
- Analyzing the structure of a presentation, and
- Distinguishing between relevant and irrelevant information [p. 148].”

The development of these skills is important in order to create effective communication learning tools. Huang [2003] provides suggestions on how to improve learner’s motivation. Huang explains that it is important

- To establish a sense of community by getting to know students and establishing trust.
- To learn more about students by conducting surveys at the beginning of a course to know about their background, concerns, and motivations.
- To take advantage of the established trust created by the positive atmosphere to conduct group activities.
- To set clear objectives that allow learners to set their own goals about what they would like to retrieve from their learning experience.
- To create a positive learning atmosphere and encourage learners to share their experiences.
- To be enthusiastic because an instructor’s enthusiasm and energy may be contagious to students and greatly influence their learning.

- To organize learning to allow students to adapt their learning to personal experiences.
- To challenge students since easy tasks often lead to boredom.
- To provide feedback to keep student motivated. The instructor's feedback as well as peer feedback is important for motivation.
- To allow for the learner's self-assessment by encouraging them to think about what they have learned and if their objectives have been met.

## **SELECTING EFFECTIVE MEDIA IN EDUCATION**

Podcasting is becoming an important tool in higher education courses. Universities have recognized the capabilities of this technology and have been conducting pilot projects and implementations to have courses available for their students. The selection of the proper media for instruction is important during implementation.

Heinich [1982] defines instructional media as film, television, radio, audio, photographs, and printed materials that are used to carry instructional content. Once the media, for example, audio or television, choice has been identified, it is important to follow guidelines for selecting quality media. Patsula [2002] describes eight guidelines that educators can use to select media in order to improve their instructional value. These characteristics are cost, accessibility, social-political suitability, cultural friendliness, openness/flexibility, interactivity, motivational value, and effectiveness. Cavert [1974] identifies a three-step process for selecting quality media: "First make an inventory of available media. Second, decide how each media available is intended to be used in instruction. Third, determine the level of the learner's performance with the classification of instructional tasks [p. 27]." Romiszowski [1988] points out major factors that affect media choice: instructional methods, learning tasks, learners' characteristics, and teachers. Instructional methods determine the choice of presentation media and learning tasks determine the choice of suitable methods. The teacher's attitude is vital in the success of using appropriate media in instruction; an open mind and positive attitude ultimately brings success to the implementation of media.

The key in selecting the appropriate media is related to the effectiveness of that medium in meeting the objectives [Allen, 1974]. The most important part of instructional media selection is the design of the overall message that the teacher tries to convey as part of the relationship with the learner [Romiszowski, 1988]. Romiszowski stresses that media selection should be part of the overall process of lesson design.

## **METHODOLOGY**

### **POPULATION AND DATA COLLECTION**

The goal of this paper was to help California State University, San Bernardino faculty create quality podcasts for their courses. The university's Teaching Resource Center and the Office of Distributed Learning provided important assistance in this effort. Faculty members have started to use podcasting in their courses.

The data collected for this project focused on implementation reports, interviews with experts in the field, and a focus group interview. The objective was to identify, with the assistance of experts, the factors important for the successful implementation of podcasting.

Executive reports of pilot projects at Duke University and the University of California, Davis between Fall 2005 and Spring 2006 were collected and carefully examined. The reports provided an overview of general objectives, design, development, advantages, disadvantages, and the upgrades in infrastructure needed to support podcasting. The researcher thoroughly examined objectives and primary goals of using podcasting at the two institutions, a summary of the courses piloted, reasons as to why the courses were chosen for the pilot programs, selection of recording hardware, distribution methods, challenges, and a summary of student feedback and statistics.

The researcher used implementation report data and a literature review to construct a questionnaire that was later distributed to two faculty members at California State University, San Bernardino. The faculty members were asked to answer questions concerning their educational background, objectives for the use of podcasting in their courses, their perceived advantages and disadvantages of podcasting and major factors for the effective use of podcasting in the classroom. The two faculty members completed the questionnaire and were interviewed during the summer of 2007. The interviews were digitally

recorded. Finally, through a focus group interview at California State University, San Bernardino, experts in the field assisted with the analysis of data collected and the identification of the main factors that contribute to the effective use of podcasting. The focus group consisted of three faculty members. The interview was also recorded.

## **DATA ANALYSIS**

Qualitative research methods were used to analyze the data collected. Researcher first conducted a thorough analysis of the information collected through the literature review and constructed a list of the major factors that contribute to the effective use of podcasting. The researcher also reviewed implementation project reports of Duke University and the University of California, Davis to identify major factors, advantages, and disadvantages of the implementation of podcasting in higher education. Similar information was extracted from the recorded interviews of the two faculty members. The recording created during the focus group interview also was analyzed and summarized.

## **RESULTS AND DISCUSSION**

The Digital Lecture Recording and Distribution pilot program at the University of California, Davis was the first report analyzed. One major characteristic of this project was the focus on development of infrastructure for capturing and delivering content. The university's implementation consisted of converting an existing lecture recording service for students into a program that allowed immediate access to digital lecture recordings. These recordings would be available through the student access website and course website for download using RSS to allow for subscription. At first the objective was only to stream the recordings, but the mechanism provided by MediaWorks, a media contractor used in this project, allowed for the recordings to be stored and be immediately available to students.

Important factors in the selection of recording hardware were to choose a product that could directly compress live recordings into mp3 format and maintain audio fidelity. To preserve sound and avoid atmospheric noise interference, the recording device selected was connected directly to the lecture hall media console. During the second quarter of the academic year, the hardware was updated to a second recorder that included extra features such as auto-pausing for extended periods of silence and resuming once sound restarted.

Once the infrastructure was developed, the project focused on developing effective distribution methods. They used the university's common management system that allowed for the content to be posted on course websites allowing students to download files to their computers or a digital music player. Mediaworks created a website that allowed students to download files and subscribe to RSS feeds via programs, like iTunes, that automatically downloaded any subsequent lectures. The main advantage of the system was that it allowed for easy access to lecture content to be used in different ways, such as study sessions. Student's access to recordings exponentially increased throughout the two quarters of testing, especially in the access to courses where the complexity of the topics was much greater. Faculty comments assured that attendance did not suffer by having the lectures available online. Also, a very low percentage of technical difficulties were reported.

The Duke University iPod First Year Experience Final Evaluation Report described the implementation project undertaken by Duke University with podcasting in higher education. The use of iPods was one main characteristic of the project that focused on the feasibility and effectiveness of podcasting. The Center for Instructional Technology coordinated the data collected from students, faculty, staff, and administrators about their views and overall experience in the use of this technology.

The first step in the project was to identify academic uses of podcasting. The main use of Podcasting was as a course content dissemination tool via its common management system servers, iTunes, Blackboard, and other websites. It also served as a classroom-recording tool to capture lectures, discussions, and provide feedback. Podcasting provided faculty and students with portability of their course content in digital form. Course content could be accessed in any location at any time. It increased student participation in course discussions. Finally it provided a support tool that could be adapted to a student's specific learning needs.

In addition to numerous benefits, there were also challenges of using podcasting for academic use. The main one was to establish an infrastructure for distribution and dissemination of content with enough

server space for accessing and sharing content. Other challenges included a lack of best practices for academic use of podcasting and the technical obstacles to producing and editing high quality recordings.

The use of podcasting in Duke University had positive effect. As a result of the implementation project, the communication between the different campus technology support teams was increased to provide better service to the faculty. The project also increased communication between faculty members about best practices for the use of this technology in their classrooms. Podcasting provided faculty with a simple way to enhance their course content and delivery and allowed them to easily change the design to adapt it to the features of podcasting. It also provided better support for faculty who had already been testing the technology but who lacked support from technology coordinators. Finally, this project identified Duke University as an innovator in the use of technology in education. The report evaluation explained that podcasting provided resources expected for foreign language courses in which students benefited from the ability of portable exercises. Podcasting provided greater flexibility than attending a laboratory did. The report also showed that there was an increase of the use of this technology in many of the other courses.

Interviews with faculty at California State University San Bernardino examined the use of podcasting in this institution. Each faculty member shared their background in education, their knowledge about podcasting, and their overall experience in the implementation of this technology. They also shared their expert opinions about the benefits and disadvantages of this technology and its future.

The first interviewee had more than seventeen years of combined experience in education. Ten years in community college and K-8 in the state of Arizona. As faculty in the instructional technology field, his expertise and knowledge was very valuable for this paper. During the interview, he shared his definition of podcasting, his knowledge of the history of the technology, major factors in its effective implementation, benefits, and disadvantages based on his experience.

He defined podcast as "a standalone audio resource which can be accessed in a variety of ways; ultimately it must be access transferable and engaged by the user in the form of a personal audio player." He first heard about podcasting from Art Bell, an innovator in the implementation of technology in radio. Later, while working at the University of Kansas, he assisted in the development of audio components that could be accessed asynchronously by students.

Podcasting provided two important features that were potential benefits for his courses. First was lecture recovery. It provided students with resources that could be accessed at any time. Second, podcasting could deliver primary course content for online courses. In his opinion, podcasting provided potential benefits that could improve overall instruction. Podcasting could help maintain student motivation and relieve student anxiety. Podcasting was asynchronous, easy to use, easy to access, and always available. It was a great tool to showcase the instructor's presence in online courses. It was valuable for students to perceive that someone was delivering instruction.

There were problems associated with the use of podcasting in the classroom. Some of the key problems identified in the interviews included that it was hard to maintain sound quality, and therefore it was important to use high-quality equipment. Also making sure that the necessary infrastructure was set in place to effectively deliver content. For example, sufficient space in storage servers, and support provided for students who might have trouble accessing content due to lack of technology resources. Finally meeting compliance with the Access for Student with Disabilities Act posed a problem for faculty as it increased production time. Although this is not a current problem, it is foreseen as a future concern. As educators are expected to take the responsibility for compliance, it will drive them away from the use of technology and it could result in a decrease of online courses.

During the interview, the professor addressed concerns commonly associated with podcasting in higher education. A concern was about the attendance reduction as students had all the content available and preferred not to attend class. Students would miss some essential content since it was impossible for an audio recorder to capture all the important information of a lecture such as group projects and interaction with fellow students. In regards to the issue of protection of intellectual property, the professor believed that the information often shared on his podcasts had no commercial value. Individual recordings could not be turned into an online class as it was a supplement to many other topics that were covered through different media. In his opinion, it was important for designers to adapt their courses to stay away from this issue, for example, in courses with more convergent subject matter or with lectures that do not change much over time. Another common problem was the lack of support for faculty developing the use of this technology for their courses. In his opinion, the Office of Distributed Learning at California State

University San Bernardino and the Teaching Resource Center already provided some support; however, they would need to increase service as the university sees podcasting as an effective resource for education.

The second interviewee had six years of experience in higher education in the information and decision sciences field. His previous experience in education was from his work in industry. Although his position at California State University San Bernardino was his first teaching position, he brought to the university a tremendous amount of knowledge about technology implementation of enterprise resource systems in industry. He heard about podcasting when it became popular in non-educational settings. While visiting Apple headquarters, he learned about the Apple Digital Initiative and various examples of technology in education including podcasting. At San Jose State University he had seen specific examples of the use of podcasting in higher education.

During the interview, he identified major factors in the successful implementation of podcasting in his courses. Podcasting provided his students with a different way to access course content. While the goal was not to create a substitute for lectures, podcasting allowed for the development of supplemental content fitted to specific student needs based on surveys conducted. The portability of podcasting allowed students to listen to course content at their own time. Podcasting allowed for the delivery of content that it was often repetitive and that did not require interaction with the instructor. This freed lecture time for discussions or different hands-on activities for students. Podcasting allowed for the delivery of content to students who would not be able to get to class.

The main problems he experienced during his implementation of podcasting were selecting the correct format for recording and compression of lectures. He conducted several tests to make the final decision between mp3 format and other proprietary file formats. Other problems included the size of files for lectures that were longer than 45 minutes and sound quality while trying to record live lectures.

During the interview, the faculty also discussed several problems often relevant to podcasting. In regards to the protection of intellectual property, he mentioned that he preferred not to record his lectures but to provide only supplemental materials and post everything behind password protected resources such as the Blackboard course management system. As California State University San Bernardino is a state funded institution, the delivery of content through course website needed to meet compliance for students with special needs. Even though compliance with accessibility guidelines might not be a current problem, he was well prepared by providing complete transcripts of his audio presentations that was formatted to meet specific needs of students with hearing and visual impairments. Although he had experienced some problems with support from his college division because of format compatibility issues. He felt that this could be a problem for other faculty with limited technology experience. In regards to the support of institutions for faculty developing courses using this technology, he felt that the Teaching Resource Center at the university provided great support for faculty.

The results generated from the focus group interview indicate that podcasting provides flexible access to course content that can serve the needs of different type of learners. It allows students with specific needs to access content at any time for continuous review. It also provides an instructor's presence in online courses. Podcasting brings many potential benefits to the classroom; it is asynchronous, it is available at any time, and could be accessed from any location other than the classroom. The development of cheaper hardware and user-friendly software allows podcasting to become a cost effective resource that is simple to use and simple to access. In addition, podcasting can enhance student motivation.

Podcasting had many potential benefits for education. In order to be effectively implemented, faculty needed to think through key issues that were relevant to podcasting: the main objectives for the use of the technology, the type of content being distributed, the target audience, delivery method, budget, and infrastructure. The protection of intellectual property and compliance with the guidelines for assistance to students with disabilities were key issues for podcasting implementation as well.

## CONCLUSIONS

Often a definition or "how to..." report does not provide the necessary information to determine if podcasting can be effectively implemented in a course. This paper analyzed the history of podcasting and the use of audio in education to identify important factors for its effective design. Additional information was obtained with the assistance of experts who analyzed implementation reports and use their personal

experience to determine common objectives, potential benefits, and problems associated with this technology. Knowledge of these factors and common issues can assist an instructor to determine the feasibility of podcasting in their courses.

Although podcasting implementation projects differ in process, many factors that contribute to its effective use are common among them. The basic knowledge about the use of audio in education is important in the design of effective podcasts. Design guidelines of podcasts need to take into account content, context, quality, length, and file format based on the characteristics of the target audience. In order to establish podcasting for effective instruction, a designer needs to use set guidelines for the selection of media in higher education.

Common objectives for the integration of podcasting in higher education include the development of a tool for primary content delivery, lecture recovery, and the portability and flexibility of digital media. The potential benefits of podcasting include; maintaining student motivation, freeing time for discussion during lecture sessions, providing resources that can be accessed by students at any time, be asynchronous, simple to use, simple to access, and provide a sense of instructor presence for online courses. Common problems identified include; the development of recording and distribution infrastructure, lack of best practice methods, formatting of digital content for distribution, decrease in student attendance, protection of intellectual property, available technical support, and issues with compliance with guidelines for assisting students with special needs.

Ultimately it is important to identify the possible applications of podcasting and common issues associated with this technology. Increased knowledge of these applications and issues will assist in the development of best practice methods needed to streamline the implementation process of podcasting in higher education.

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