IPODS: REDUCING MATHEMATICS TO SOUND/VIDEO BYTES

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Portable music players and other devices for downloading movies and news have become increasingly popular among students. The proliferation of lightweight, multifunctional players has led many educators to investigate possible educational uses of these devices at all educational levels. In particular, mathematics and science instructors have become interested in the recent trends in video podcasting. In this article we describe how to produce audio and video clips for podcasting tidbits of mathematics. Examples are provided at www.mathbyte.net.

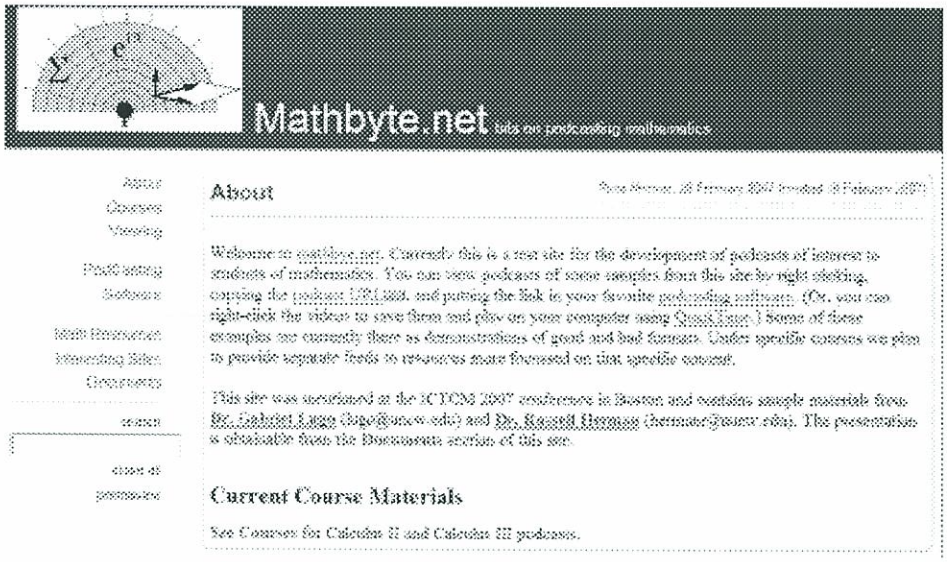

Figure 1. Website at www.mathbyte.net

In September 2005 Apple introduced the video iPod as a significant change in their line of iPods, which have been commercially available since 2001. The use of the versatile iPod has been the subject of investigation by a number of educators and several universities have invested in massive deployment of the device for instructional purposes. However, it was not until the video iPods appeared that mathematicians became seriously interested in these devices to enhance their teaching. These machines feature 30 GB and 60 GB hard drives and a widescreen color display that is two and a half inches wide with a 320x240 pixel screen.

The marketing success of iPods is due mainly to the ease of the process by which users can download audio and video content. Apple introduced the now famous iTunes. In iTunes one can subscribe to podcasts by simply pasting the URL to an RSS (Really

Simple Syndication) feed or logging into the iTunes store. We should note that one does not need iTunes to view the content nor does one need an iPod to subscribe to an RSS feed. There are several other podcatchers, or aggregators, similar to iTunes. Another example is Juice (http://juicereceiver.sourceforge.net/index.php), which is also free. The downloaded content can be viewed on desktops, laptops, and other mobile devices.

Educators are not the only ones competing for the attention of their audiences through podcasts. An abundance of radio station audio podcasts, many with educational content, have been available for years. More recently, television news programs have been providing video podcasts adding more depth, or even reruns, of their broadcasts.

Prior to the ICTCM meeting in 2007 we conducted a poll of two classes, Calculus 2 and Calculus 3. The class sizes are roughly the same, close to 30 students each. We found that students are increasingly using mobile devices, such as laptops (Figure 2). In this nonscientific survey, we found that the younger class not only uses more mobile technology, but they also seem to own and use MP3 players and iPods a bit more. We were surprised to see how many students actually own video iPods, though many do not know how to use them to download simple movies or prefer using computers to play them.

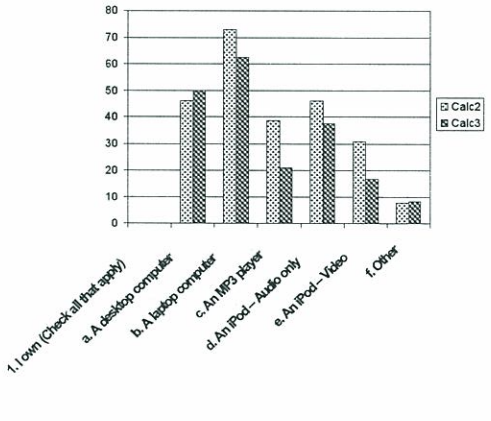

Figure 2. Hardware Ownership

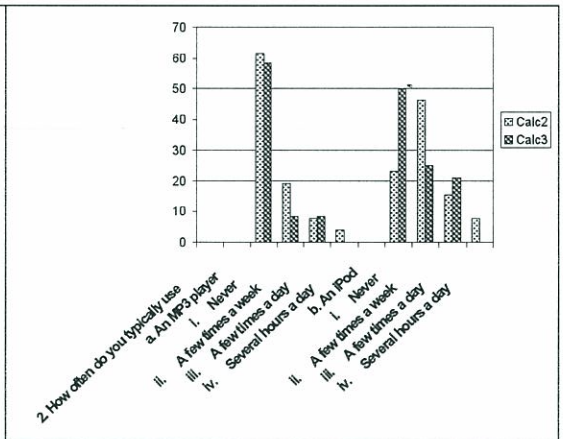

Figure 3. Use of MP3 Players and iPods

In spite of this growth in ownership, students are not using the technology as much as they could (Figure 3). This may be because there are not yet a significant number of classes using the technology. One problem with the survey is that many students do not even know what a podcast is. Though students do listen to podcasts (Figure 4) and they understand that you do not need special devices to download podcasts. This number seems to be increasing as seen in Figure 5. The most common types of downloads are music and news, combined. However, most students are enthusiastic with the idea of using podcasts in their classes.

The new technology provides an opportunity for mathematics and science teachers to

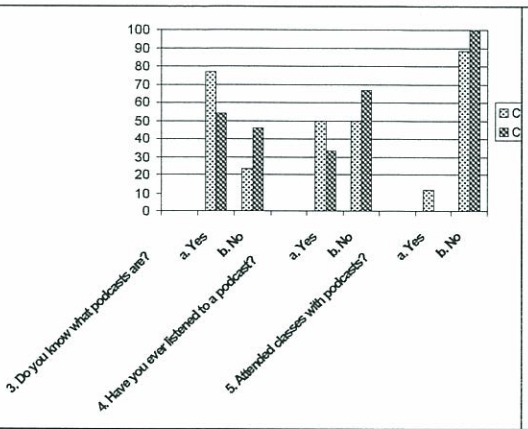

Figure 4. Podcast Use.

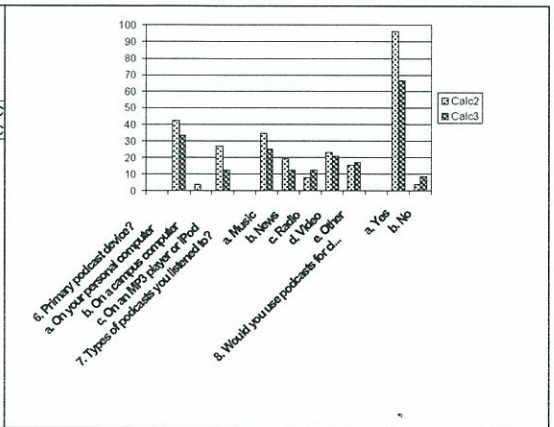

Figure 5. Podcast Downloads

further promote learning beyond the classroom. By attaching audio and video annotations to class notes, sample exams, CAS worksheets, and other common simulations, we can add instructional value to otherwise static pages. We have done this by capturing verbal annotations of our writing on Tablet PCs or previously prepared electronic documents. We have been successful in this task using the following free software packages:

- CamStudio 2.0 to do screen captures
- MediaCoder for converting the resulting AVI file to MP4
- Audacity to create and edit audio content
- RSS Builder to create an RSS feed

What does it take to set up classroom content? The key steps are: 1) Plan the lesson, or module; 2) Record the lesson; 3) Edit the recording; 4) Put the media file on a web server capable of delivering multimedia files; 5) Create an RSS feed to the media file; and finally, 6) Disseminate the URL of the feed.

The hard part of the process is figuring out what you have to communicate and arranging it within the form factor of the iPod. In our case we found it easy and convenient to use the digital ink capability of a Tablet PC to record small lessons. However, one can also capture carefully designed worksheets and presentations without the need for a pen-driven machine. In order to grab screen activity and audio, we have utilized CamStudio

CamStudio 2.0 is an open source version of a screen capture program. It records the audio and video during a session, displaying all activities taking place within a user determined window. It allows the movie to be saved in Microsoft's AVI format. CamStudio 2.0 is free. A recent update to version 3.0 allows for direct capture to the MP4 format, useable on iPods. However, it is not longer free.

The AVI format is not readable by iPods or iTunes. So, the files need to be converted to an MP4 compressed video. We have found MediaCoder to work well at no cost to the user. Typical video compression to MP4 typically takes at least one MB of space to

record one minute. Recording full lectures could take several gigabytes in order to provide a full course online. However, less space is needed for providing small recording of separate examples, history lessons, etc.

You may not need the full power of video. Sometimes audio files might be useful, such as a verbal summary of topics for an upcoming exam, or a discussion of historical figures and event in mathematics. In this case, you can just use you computer equipped with a microphone to record your audio. (Do not use the built in microphone, as the recording is often not as crisp.) While you can record using software that comes with the computer, you might want an audio editor. Audacity is a free open source program which works quite well and allows for the saving of the audio as an MP3. These files are easily played on MP3 players (of course), iPods, PDAs, laptops and desktops.

Where will these files be stored and how can students access them? You need a dedicated server. You may find university computer administrators uncooperative because of the disk space requirements. Also, the server must be configured for broadcasting of media. You could go to a web hosting service, of which many exist for posting web sites, blogs, and the like. These typically cost some nominal fee. However, space is less an issue.

Once the video files are loaded on a server, the simplest way to give students access them is to provide them with direct links. For a more organized distribution, you can create a web page with hyperlinks organized by topic. For true podcasting, you can create an RSS (Really Simple Syndication) link for the students to download through a podcatcher, such as iTunes or Juice. Streaming the files is another option but it requires a little more expertise.

Downloaded files can be played on a typical desktop computer, laptops, or a variety of mobile devices. MP3 files generally can be played using most media players, such as Windows Media Player or Winamp. However, MP4s do not always play correctly. One can use QuickTime or RealPlayer. Other media players may work provided the proper codec is downloaded. However, students should not be expected to worry about such details. In the future we expect this issue to be more transparent to users. Finally, students can download the media files to their machines, by rightclicking on the link, and then importing the file directly into a program like iTunes.

What distinguishes a podcast from other types of broadcasting is that users can have media content automatically downloaded for offline viewing. Streaming, on the other hand, is asynchronous broadcasting in which viewers can view the content, but have to be online and the file is not downloaded to their machines for future use. If you want users to subscribe to your collection of media so that they can have new media files automatically downloaded through a podcatcher, then you need to create and maintain an RSS file. Users can then link to this file which contains the metadata for the resources at your site. While the more adventurous reader might want to learn how to do this on their own, there are RSS editors, such as RSS Builder, which provide a simple interface for creating the RSS file. The RSS file is then placed on the webserver with a link that can be

copied into a podcatcher. More information on how to create an RSS feed can be found at places like http://radio.about.com/od/podcastin1/a/aa030805a.htm or at our web site.

At www.matbyte.net we have been testing different ways that podcasting might be useful for a typical mathematics class. We have found that there are significant advantages to being able to place video content on topics that we previously posted in a static form. One does not need to create sophisticated, or long, lectures. However, no matter how short the mathbyte, we find ourselves becoming a little picker about the final product than we were with static information. After a bit of practice, this initial inclination towards perfection is relaxed, while the comfort level and speed at which we can put up annotated materials increases. As with any new technology, we should be ready to explore the possibilities that might enhance what we do in and out of the classroom. We know our students are ready for us to deliver podcasts to them.

Software Resources

There are many types of software used to create these podcasts. For us, we wanted something simple and inexpensive. Here is a sample of the software used:

- **CamStudio** - http://www.camstudio.org/. This software is a screen capture software similar to Camtasia (http://www.CamtasiaStudio.com). It captures records activity from your screen and audio from a microphone into AVI video files. More current versions may convert directly to MP4, but are no longer free. See also http://sourceforge.net/projects/camstudio/.
- **Audacity** - http://audacity.sourceforge.net/. This is a free audio editor and recorder. You can use this to record, edit and save MP3 files.
- **MediaCoder** - http://mediacoder.sourceforge.net/. This is a free media converter. It can be used to convert the CamStudio AVI movies into MP4s.
- **RSS Builder** - http://home.hetnet.nl/mr_2/43/bsoft/rssbuilder/. This is a program that helps to create and maintain RSS feeds for audio and video content.

Online Math Podcasting

There currently are several other efforts into looking at using podcasting to deliver mathematics content. Other links to science content are posted at our web site.

- Dan's Math http://dansmath.libsyn.com/
- Mathpod http://www.mathpod.net/index.htm
  http://www.mathgrad.com/shownotes.html
- The Math Factor http://www.podcast.net/show/83323
- MapleCast http://www.maplesoft.com/community/podcast/
- iPod@mathdemos –http://mathdemos.gcsu.edu/ipodmathdemos/index.html