INTEGRATING IPODS AND PODCASTING INTO MATHEMATICS INSTRUCTION

Lila F. Roberts, Amy F. Kelley, and Hugh A. Sanders
Georgia College & State University
Department of Mathematics
Milledgeville, GA 31061
lila.roberts@gcsu.edu, amy.kelley@gcsu.edu, hugh.sanders@gcsu.edu

Introduction

A growing number of universities are making use of iPod and podcasting technology to enhance instruction. Although many of the iPod projects involve delivery of movies and audio content in areas such as history, music appreciation, geography, and language, there are relatively few formal such projects designed for mathematics. At Georgia College & State University (GCSU), iPods and podcasting have been used in mathematics classes in three distinct contexts: visualization, assessment, and presentation. This paper will discuss implementations of these emerging technologies for student engagement in and out of class.

Visualization: iPods in Calculus Instruction

In Fall 2006, a project to integrate iPods and podcasting into Lila Roberts' first semester calculus class was implemented. The audience was a group of nineteen freshman mathematics and pre-engineering students. Each student received a loaner 30gb video iPod for the semester and each student subscribed to the podcast channel for the class.

The emphasis of the implementation was on visualization and many of the materials developed for the course were adapted from the National Science Foundation proof of concept project Demos with Positive Impact (DUE-9952306). The content focused on "every day" material used for basic examples and enhancement.

The visualizations were delivered by two different modes of animations: flickbooks and videos. Flickbook animations are built frame-by-frame, as in a Disney animation. Figure 1 shows the iPod display of the albums and frames for an investigation of continuity of a piecewise function. Navigating to the frames in the album, one selects the first frame and

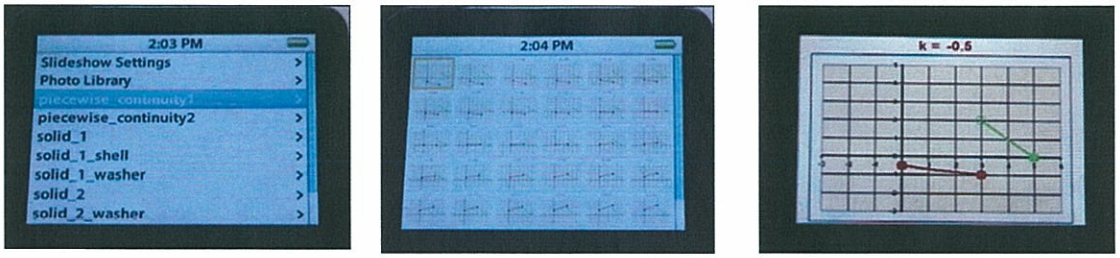

Figure 1. Album and Frames for Flickbook Animations

it appears in a full screen. The animation is then generated as the user uses the clickwheel to scroll through the frames. The animation can also be displayed as a slide show, however, use of the clickwheel gives the student a level of interactivity and the flexibility to move backward and forward in the animation.

Visualizations captured as videos provide the opportunity to include audio in the form of explanations of the action in the video in the context of the mathematical concept being presented. Students had the option of downloading the video for playback on iPod or as a podcast within iTunes (Figure 2). Other types of videos were prepared, including step-by-step problem solutions, as well as quiz and test reviews.

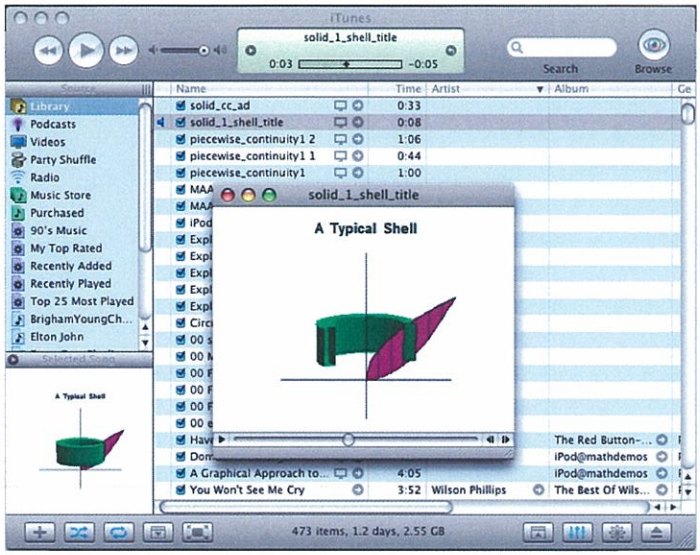

Figure 2. Video playback in iTunes.

Although student reaction to the use of iPods and podcasting was largely positive, the implementation was not without hiccups. Students generally had no trouble downloading their music into the iPod, but several had difficulty subscribing to and updating the podcasts. In addition, most students had difficulty managing the flickbook animation albums. Future implementations will include more instruction in basic iPod navigation and file management. The types of podcasts students seemed to like most were the step-by-step problem solutions, which reinforced the examples presented in class.

Assessment Strategies to Strengthen Students' Mathematical Communication Skills

One of the student learning outcomes of the Mathematics program at Georgia College & State University is proficiency in oral communication of mathematics. Communication of mathematics is a skill in which many students have difficulty. Beginning students lack mathematical precision and vocabulary as well as confidence in using mathematical language, especially when speaking. Amy Kelley designed a series of audio homework assignments to measure and improve student's ability to speak mathematically.

The audio homework assignments had two components. The first component required students to explain and describe some mathematics related to the course content. The student then recorded his/her description of the mathematics. A total of five different mathematical vignettes were included within each assignment. Each student was responsible for describing one vignette did not see the others. In the second part of the assignment, students listened to the recordings and provided critiques to their classmates. Each student completed a pre-test, two content audio assignments and a post-test. In addition, each student critiqued approximately 15 recordings during the semester. Twice during the semester the students completed attitudinal surveys regarding the audio homework assignments.

The project was implemented with twenty non-science majors in an elementary (freshman level) Introduction to Mathematical Modeling course during the fall of 2006. The course was clustered with an interdisciplinary science class and students were required to be enrolled in both classes. Content and assignments were integrated in both courses and oral presentation was a significant part of students' evaluation.

The iPod seemed a reasonable technology choice because of its portability and student familiarity with the technology. Distribution of podcasts could be easily facilitated by the university's Podcasting server, and students in iPod-enhanced courses could receive a loaner iPod for the semester. Although there were very good reasons to choose iPod as the technology platform, implementation of the project posed several challenges. The original intent was for the students to use iPods for both recording and critiquing the assignments. Beginning in the fall of 2006, the iPods used at GCSU were brand new 5^{th} generation video iPods. Unfortunately, during the summer development time prior to the start of the semester, voice recorders for 5^{th} generation iPods were not available. An alternative plan for recording involved outfitting computer labs with microphones and Audacity, a free audio recording and editing program. When the semester began, students were given instruction on how to make their audio homework recordings, save them in mp3 or Garageband file format, and email to their instructor. After receiving the file, instructors modified the file format as necessary and made the student information anonymous before uploading to the Podcasting channel. Once the files were posted, students subscribed to the podcast channel and downloaded the podcasts into iTunes.

Some of the instructor's initial observations about the project pertained not to student learning, but to teaching in general. Although the assignments were designed to focus on spoken communication, it became clear the assignment also required the students to listen, read and analyze the mathematical content. Indeed, in comparing the student's recordings to their critiques, the question of how listening, as well as speaking impacts a students' learning. This is an area that will be explored in subsequent experiments.

The initial implementation of the project led to some valuable lessons learned. One important lesson was a realization that the workload should be decreased. Student critiques were completed on paper (anonymously, to encourage honest critiques), collated, and returned to the students, with each student receiving copies of all the critics'

evaluations. The critiques could be made less labor intensive on the instructor by making them electronic.

Another lesson learned was that students are not always as technologically savvy as might be expected. Even though all 20 of the students enrolled in the course brought their own laptops to campus, the learning curve for some students on seemingly simple tasks (such as creating an mp3 file) was steep. Overall, the sample size and absence of a control group prevent the ability to draw strong inferences. However, an increase from the pre-test to the post-test in some students' ability to use mathematical language correctly and effectively was observed. The iPod itself was seen to be minimally effective in helping the students' achieve the desired learning outcomes because most students indicated that they used their personal or library computers to complete the audio homework assignments.

The audio homework project will be implemented again in the fall of 2007 in a similar cluster of classes. The new experiment will increase the size of the data set and address some of the challenges presented during the first implementation.

Presentation: Podcasting Class Lessons

Instructors need to miss classes from time to time, sometimes for several consecutive days. Although willing colleagues are able to cover some classes in the instructor's absence, an alternative way to deliver course material would be advantageous. One solution to the problem is to pre-record class lessons and distribute to students. An excellent delivery mechanism for pre-recorded lessons is by podcast, a method Hugh Sanders used during a week-long trip to a professional conference.

Podcasting provides an effective way for students to access recorded class material and to play them back repeatedly, if necessary. Students can access the recordings from websites set up for distribution, from CDs placed on reserve in the library, or by sharing with fellow students. At GCSU, a podcasting server provides an easy delivery mechanism for the podcasts.

Technical aspects involved in creating the podcasts include recording on tape or DVD, conversion to mp4, and burning to CD. In this implementation, a lesson was recorded onto videotape then transferred to DVD (Figure 3).

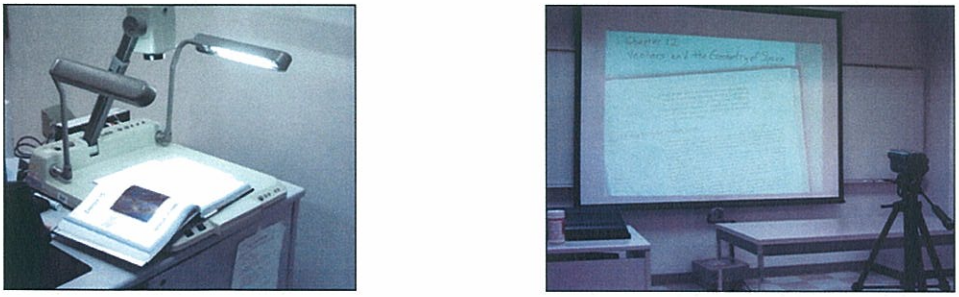

Figure 3. Elmo camera shot of lesson and recording lesson on videotape.

Using a DVD recorder, the videotaped lesson can be edited and burned onto a DVD. Then using a utility such as Clone DVD Mobile can be used to convert the lessons to mp4 format which provides a file size more suitable for managing uploads and downloads.

The final step in the process was uploading the file to the podcasting channel for the class. The GCSU Podcasting server provides statistics to inform the instructor of the number of downloads for each episode, which gives an indication of the number of students who accessed the file (Figure 4). To make sure each student had access to the podcasts, even if they had technical difficulties, a CD was placed on reserve in the library.

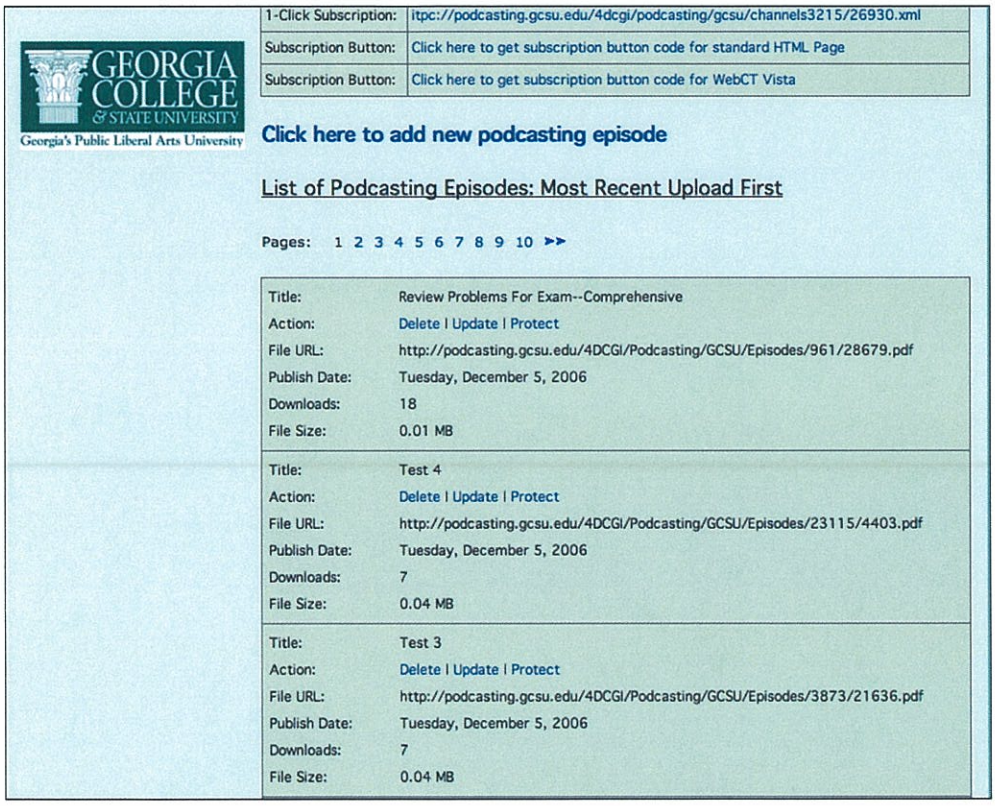

Figure 4. Sample statistics provided by GCSU podcasting server.

This approach to covering classes during instructor absences ensured that the class proceeded smoothly and colleagues were not inconvenienced.

Summary

This article has described three distinct ways in which iPods and podcasting have been utilized in mathematics instruction at GCSU. Although data is inconclusive as to actual improvement of student learning, the portability of iPod and availability of mathematical content for download certainly provides excellent access. The "cool" factor of iPod is also an added benefit.