

Using Video Podcast to Enhance Students' Learning Experience in Engineering

Imin Kao

Department of Mechanical Engineering
State University of New York (SUNY) at Stony Brook
Stony Brook, NY 11794-2200
Corresponding author: imin.kao@sunysb.edu

Abstract

The students and faculty today have available to them many technologies that did not exist a decade ago. Such technologies can be great tools for the delivery of course contents to enhance students' learning experience. In this presentation, podcast is employed as an asynchronous online tool in engineering courses to record lectures and supplementary materials. The University podcast server is configured for students to download the episodes of organized lectures and supplementary materials. Mostly, this is done on *iTunes*, available on both PC and Mac. The podcast contents appear as a playlist on the "Podcasts" directory in iTunes, although students can also download the files and view them in other media players such as Window Media Player. Various modules of supplementary materials were published as podcast episodes in addition to the regular lectures. Such supplementary lectures include clarification of concepts in lectures with necessary materials and media which facilitate the understanding of topics presented in the class, such as problem formulation and solving. Surveys conducted at the end of the semester and analysis are used as an assessment tool to evaluate the effectiveness of integrating podcast to teaching. This pedagogical tool for asynchronous teaching and learning has recently been employed in the online engineering program in the State University of New York (SUNY) at Stony Brook.

Index Terms – Assessment, Asynchronous learning, Online courses, Video Podcast.

1. Introduction

Millennial students grow up with exposure to technology and are quite adapted to live with technologies, including their products and benefits. As a result, they are also pushing, and perhaps challenging, faculty to expand their technical horizons. Both students and faculty today have available to them many technologies that did not exist a decade ago. Such technologies can provide us with important tools for the delivery of course contents in order to enhance the learning experience of students. Furthermore, students will feel empowered to learn with technology and be comfortable with, and capable of excelling in, diverse learning situations with various tools and technologies. The environments in which learning takes place can profoundly affect their satisfaction with the quality of their educational experiences. Because of their inclination in technology, they are potentially more affected by the technology in their learning environment than their parents.

In this presentation, an asynchronous online tool is employed in engineering courses to record both classroom lectures and supplementary materials, and to make them available through podcast publishing. According to the Wikipedia [1,2], "A *podcast* is a digital media file, or a series of such files, that is distributed over the Internet using syndication feeds for playback on

portable media players and personal computers. A podcast is a specific type of webcast which, like 'radio,' can mean either the content itself or the method by which it is syndicated; the latter is also termed *podcasting*." Video podcast is an enhancement of audio podcast with video. Various debates are not lacking at all on the podcasting and its benefits and harm, as well as applicability to teaching and delivery of course contents [e.g., 3,4,5,6]. Some argues that "lecture-cast" is a poor way of teaching. In this paper, I will present a way of utilizing the technology with video podcast, with an objective to enrich the learning experience of engineering students.

The University podcast server is configured for students to download the episodes for modules of organized lectures and supplementary materials. Mostly, this is done with iTunes, available on both PC and Mac, which appears as an playlist on the "Podcasts" directory, although students can also download the files to view in other media players such as Window Media Player [10]. During the period of one semester, modules of additional materials to supplement the lectures were also given as podcast episodes in addition to the regular lectures. Such supplementary lectures include clarification of concepts in lectures with necessary materials and media which facilitate the understanding of topics presented in the class, such as problem formulation and solving. Surveys conducted at the end of the semester and analysis are employed as an assessment tool for evaluating such experimental implementation of integrating video podcast in teaching. Instructor's experience in teaching this course will be presented in view of what worked and what did not work, as well as feedback and suggestions from students.

This pedagogical tool for asynchronous teaching and learning has recently been employed in the online engineering courses offered by the State University of New York (SUNY) at Stony Brook. Issues of copyright and University regulation for online media and education, as well as their relationship to the preparation and delivery of lectures, will also be discussed.

2. Podcast as a Teaching and Learning Tool

The second half of the 20th century had seen tremendously changes brought about by the invention of the first transistor in 1947, followed by the planar technology and IC, and the emergence of information technology [e.g., 7,8]. Students today have technologies and information at their disposal that did not exist a decade ago. For example, many teenagers purchase, on a regular basis, various merchandise and commercial products online, which the earlier generations used to purchase in department stores. The millennial students are more ready to accept and embrace new technologies and adapt their lives around them. Technologies have simply become part of their lives and learning process. Even the Coca Cola CEO said recently that he watches YouTube regularly to keep updated on what are out there.

That being said, I believe it is plainly wrong to use technology in classrooms simply for the sake of technology. Sound pedagogy should remain the first principle behind the adaptation of technology in teaching. It is important to put in perspectives several important aspects of utilizing podcast as a teaching and learning tool in classrooms and in asynchronous learning environments often found in online teaching. They are as follows:

- evaluate and make available new podcast technology to faculty and students;
- train faculty to become more comfortable with new technology;
- support the development of and allocate the resources to new technologies; and
- transplant and assess pedagogy utilizing such technologies to enhance students' learning.

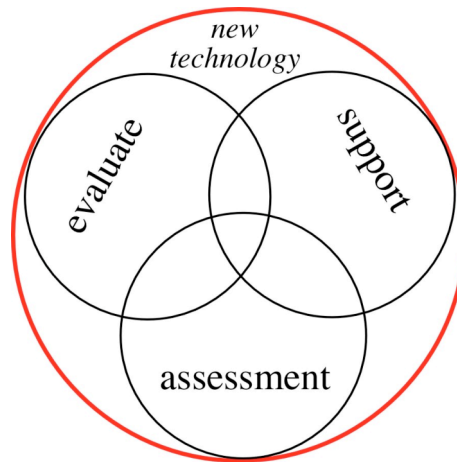


Figure 1: Illustration of the important aspects of the introduction of new technology, such as video podcasting, to teaching and delivery of course contents. The three aspects of evaluate, support, and assessment are intertwined, each with its own importance and independence, and yet intersects and interacts with one another, under the context of new technology.

2.1 Evaluate and Make Available New Podcast Technology

New technology such as video podcast can be a great tool in teaching and learning. However, before adopting new technologies, evaluation of such technology in supporting sound pedagogy is crucial for the successful application in teaching. There are issues to consider and evaluate. For example, with the fast changing face of technology, how do we make sure we are using the “right” one? This can be a big issue if all we are doing is the introduction of technology without the underlying sound pedagogy. How do we use technology without being constrained by it? What kind of technology do we need in our classrooms and/or online courses? Do we need it more in certain disciplines than others? These are all intriguing and valid questions that one should ask and consider.

The evaluation should be done in parallel with the availability of the technology. It is only a couple years ago that audio-only podcast makes the utility of the technology not as attractive. Today, the video podcasting enhances the capability of contents delivery and enrichment of information dissemination.

2.2 Institutional Support and Resource Allocation

New technology such as video podcast requires institutional supports and resource allocation. Depending on the level of sophistication, it will demands supports ranging from small to big investment. A computer lab and facility with studio-like equipment is necessary to conduct classroom teaching as well as recording of lectures and supplementary materials.

Furthermore, it is necessary for the instructor to modify his/her styles of teaching and preparation of lecture notes. With the availability of tablet PC and many software, making a podcast is no longer a difficult task. The training and teaching of the usage of the technology is also important, not just for the instructors but also for the students if they are required to produce podcasting projects as part of their learning experience.

2.3 Sound Pedagogy and Assessment

Technology is only a means to deliver the contents, and should not replace sound pedagogy which is the fundamental rubric. Pedagogy which promotes active learning using such technology can enhance the learning experience of students. It is the author's experience that students of this generation, who are savvy in learning and using new technology, can be challenged and motivated to use the podcast technology in production of educational materials much like what Discovery channel does in presenting scientific or engineering contents, except in a production of smaller scale. This interactive learning process, with peer learning and review, produce a very beneficial environment in which active learning and engagement in learning can naturally take place.

Assessment is the backbone of continuous improvement. This is not an exception in the application of new technology such as video podcast. What works well under the context of certain disciplines and fields does not necessarily work well under a different context. An outcomes-based assessment is necessary to measure the effectiveness of teaching, and to continuously make improvements to the development of better approaches and the integration of new technology.

3. Podcast as an Asynchronous Tool to Enhance the Learning Experience

In this section, podcast as an asynchronous tool to enhance the learning experience of students in engineering courses is discussed. First, the design and planning of courses/lectures is presented, followed by discussions on the issue of interaction with students. The assessment and peer evaluation are presented after that.

3.1 Course Design and Lectures Planning

The author found, through the experience of teaching engineering courses with podcasting, that in order to publish lectures in video podcast format, course contents often need to be re-designed or re-arranged for delivery, and lectures need to be planned in such a way to be suitable and optimal for producing podcast episodes. The conventional blackboard technique may not always be the best nor the most suitable for electronic means of delivery of course contents. The author found that the podcast lectures are best when they are separated into modules of lecture segments, with illustration of examples as supplements, and separate podcast episodes.

Short modules of 5 to 20 minutes, with each module exploring one main concept, tend to work better. Examples or illustrations (much like typical *recitation* sessions) can be used to reinforce the learning of principles and concepts. Supplementary podcast, often as a result of responding to students' questions for the clarification of concepts and/or techniques of problem solving, can be offered to students outside of the regular lectures. Due to the asynchronous nature of podcast production, supplementary materials often can be made available before the class with assignment for students to view before the class. Instructors can make decisions regarding which subjects to go through in details in class or which ones to skim through. **For example, if the objective of the learning outcome is to equip the students with skills to formulate and solve problems, more time can be spent in problem solving, with details of derivation of equations produced and reviewed by students before the class via video podcast.** This will be equivalent to additional lectures to students; however, this also comes with the benefit of revisiting the lectures at any time and anywhere when students need to. An example of planning of a lecture in the presentation of the Lagrange dynamic equation with the problem solving practice is in the following.

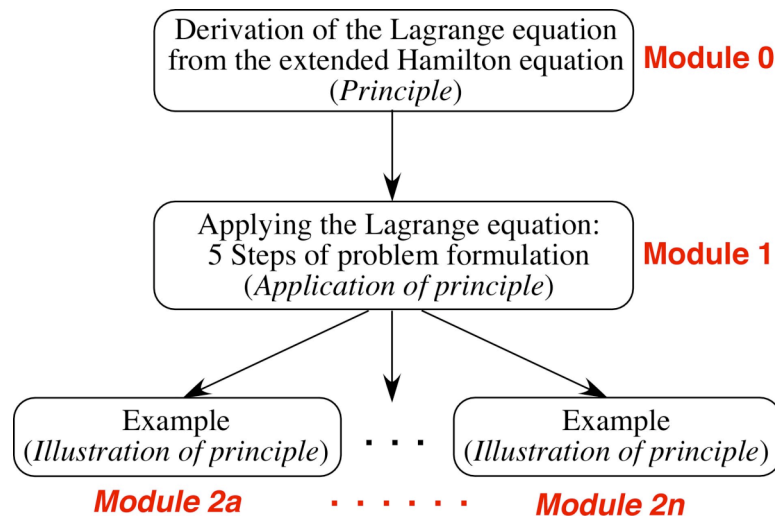


Figure 2: Example of a concatenation of modules for an engineering topic.

Module	Title and nature of module	Length of podcast
0	Derivation of Lagrange equation from the basic Hamilton's equation (<i>derivation of principle</i>)	15~20 minutes
1	How to apply the Lagrange equation to dynamic system: problem formulation and 5 steps of application (<i>application of principle</i>)	7~10 minutes
2a	Example to illustrate the principle	Varies, depending on the size and details of the example and problems
...		
2n		

Table 1: Breakdown of modules in the example of Figure 2

As illustrated in Figure 2 and Table 1, the contents of the lecture can be delivered in a similar way as that of using conventional blackboard. However, the podcast publishing requires a more careful planning of the sequence and length of production in order to make it more effective in the utilization of what the technology offers. As can be appreciated, the modules 2a~2n can be flexibly managed and controlled by the instructor to reflect the learning appetite of the class, and to adjust in both real-time class teaching and/or asynchronous delivery.

3.2 Relationships and Interaction with Students

On of the potential problems of asynchronous delivery of course contents is the danger of removing the relationships and interaction between the faculty and students in a lively classroom. Once the interaction stops, it becomes only a one-way instruction of information, and ceases to promote a healthy learning environment. The development of minds and growth in the learning of knowledge can be lost due to the lack of relationship and interaction.

As illustrated in both Figure 2 and Table 1, the response and interaction of students is critical for the instructor in order to make adjustment to use well-designed examples to motivate students to

learn. The interaction and response from students effectively “close the loop” in their learning process—making the teaching and learning a two-way process. Such two-way process is accomplished through the Blackboard system with “Discussion Board” by establishing different discussion threads for lectures and podcasts, allowing students to interact with not only the instructor but also with their peer students. Such means of communication is even more important in online courses in which students do not have the opportunity to meet with instructor face-to-face. Such communication can also take the form of video conferencing or transmission of multimedia means of communication.

3.3 Assignment and Peer Evaluation

With the availability of technology to author and deliver video podcast, conventional homework assignments and projects can also be expanded outside of the box, so to speak, by taking advantage of the capabilities and uniqueness of what the technology has to offer.

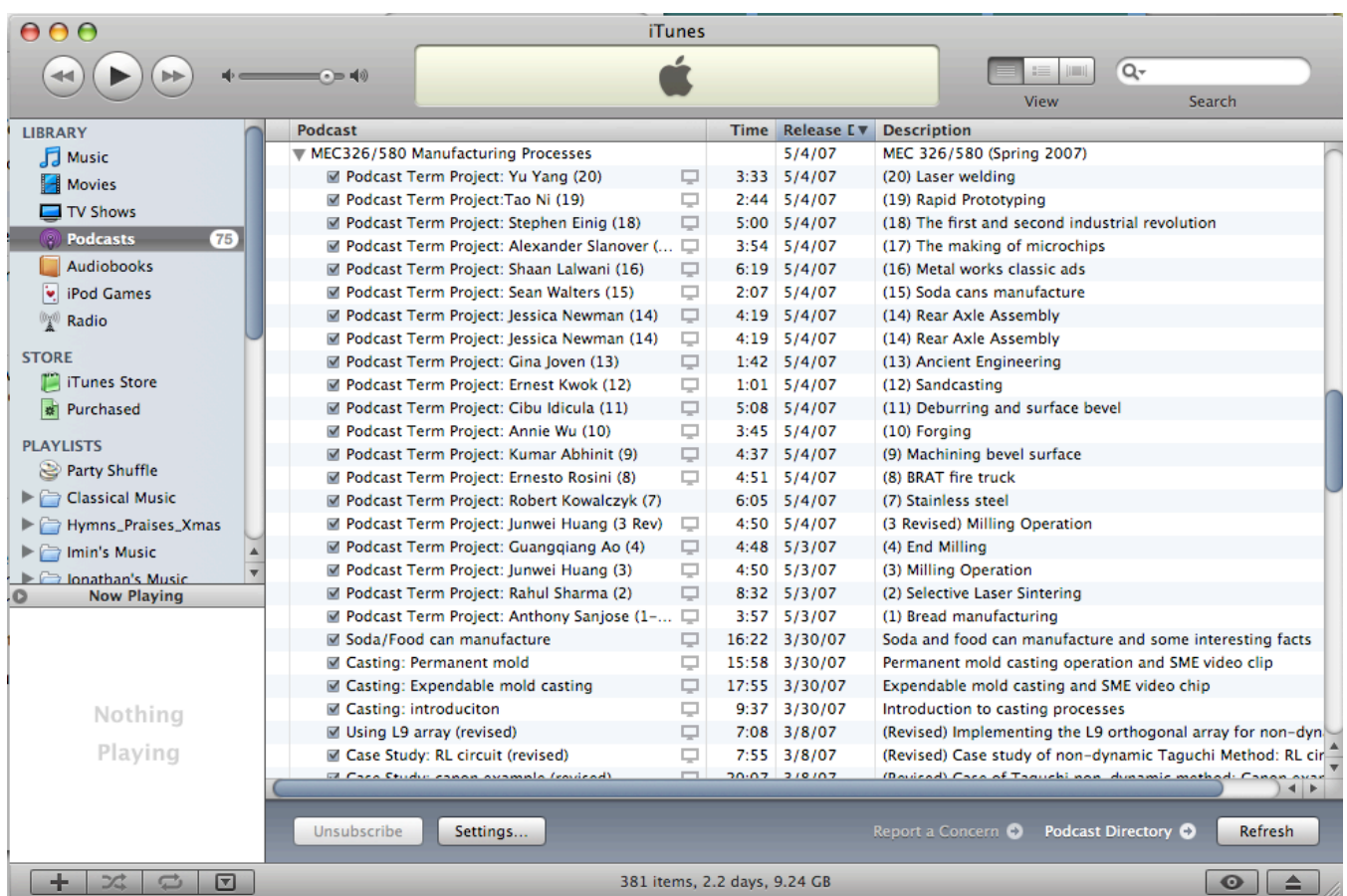


Figure 3: A snapshot of the screen of iTunes playlist of the course with students’ video podcast term projects under the peer review process.

The nature of podcasting and electronic dissemination lends itself very well to projects that can be peer-reviewed. In a class of size varying from 20 to 60 students, the author has assigned term project of podcast production using topics relevant to the subject of the course, with one and only objective to produce a 3~5 minute podcast episode such that when their peers watch it, they will learn something new. Because the podcast episodes are posted and maintained on the podcast server, students can view each one of the video podcast and give grades. Not only the term projects are graded but also the students learn from one another, not merely through the lectures

of the instructor. This peer review and learning is not possible with most traditional ways of course delivery. A snapshot of *iTunes* playlist of a course is shown in Figure 3.

4. Systems and Software for Podcast Production

In the following, the systems with hardware and software tools for the production of video podcast are described.

- **Hardware for capturing:** The lectures were captured using a tablet PC capturing system and software. The software can import files with various presentation formats such as PDF or PowerPoint. Once imported, the presentation material shows up on the screen like a conventional blackboard on which handwritten or formatted text or graphics can be imposed. The software captures and records the lecture and saves it in an .AVI file ready to be exported for the production of podcast. The AVI file includes still photos, videos, illustration, ... etc. Snapshots of the screens of PowerPoint slide with written notes imposed on were captured, as shown in Figures 4 and 5. This can be saved for the purpose of lecture notes and handout for students.

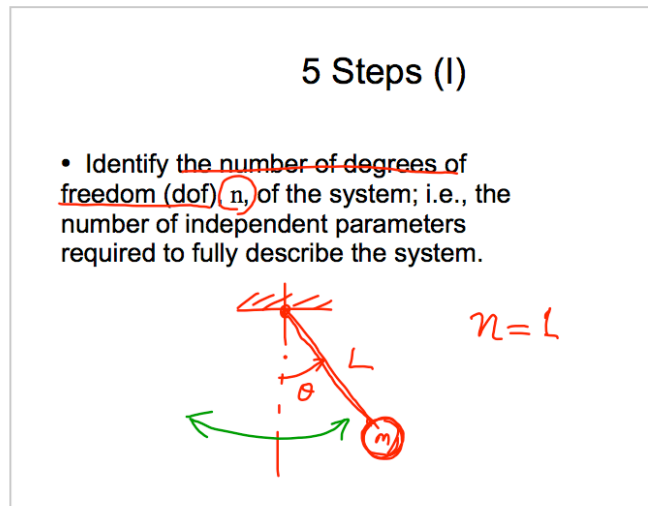


Figure 4: Screenshot 1: Step 1 of the five-step application of the Lagrange equation for dynamic systems. The hand-written notes are overlaid onto the prepared text, and become part of the video podcast production.

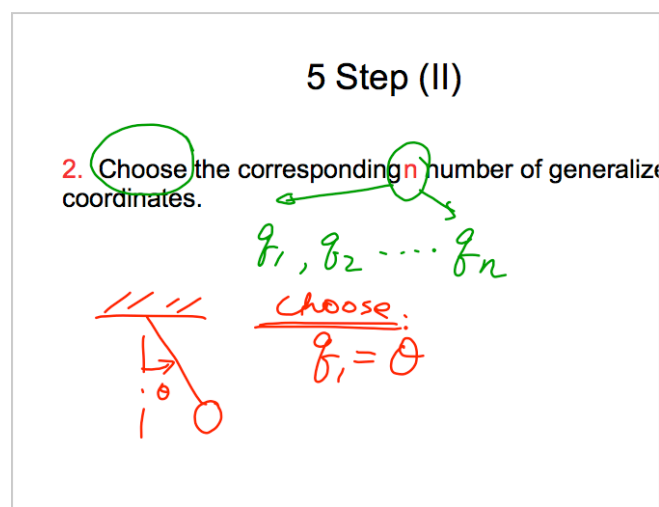


Figure 5: Screenshot 2: Step 2 of the five-step application of the Lagrange equation for dynamic systems.

- **Software for the processing and production of podcast:** Various software programs are available on both PC and Mac for producing podcast, some are free of charge while others are commercial products with a licensing fee. For the purpose of this class mentioned earlier, I have chosen Mac as the platform due to the availability of software such as QuickTime Pro, iMovie, iTunes, and GarageBand. Compatibility issues of audio and video files across hardware platform can be troublesome at time. iMovie tends to create a project that requires a larger file than that of QuickTime or iMovie. There are many available products which will meet one's specific needs. It is often a good idea to start with something reasonably small before diving into more sophisticated software and hardware systems. To this end, QuickTime Pro is the most convenient software and has been used in the production of most video podcast episodes.
- **Podcast server:** The University maintains a podcast server on which podcast episodes can be posted for students to download with RSS feed to *iTunes* on their PC or Mac. Automatic *Refresh* or *update* is made when iTunes is open and active.

5. Assessment and Summary of Results

Assessment survey was conducted at the end of class with 16 anonymous surveys returned. Of the ones returned, a brief summary is as follows.

- Over 90% of returned survey commented that the video podcast episodes are very useful, especially when they are doing homework assignments, because they can go back to look for what they were missing in the lectures.
- The statistics of the frequencies of download indicates that each lecture has been downloaded 40~80 times throughout the course of the semester. With 20 students in class, these numbers seem high. It seems to suggest that students download each podcast for more than 2 times. This number may be inflated due to sometimes unsuccessful download (for example, interrupted by lost connection), or multiple downloads onto different computer systems.
- The podcast server is password protected. This is partly due to the copyright policy of the University. In a class with video podcast episodes produced under the traditional "fair use" of copyrighted materials solely for the purpose of instruction, this is not a concern.

The Stony Brook University "Copyright/Fair Use/Teach Act" policy governing web materials and video podcast reads [9]:

"The materials in this course available online or via a website link are for the exclusive use of registered students currently enrolled in this course, and may not be retained or further distributed. In addition to legal sanctions, violation of these copyright prohibitions may result in University disciplinary action."

- Copyright can be an issue when instructors have to use copyright materials or students have to include copyright materials in their podcast production in their term projects. The education and awareness in what constitutes plagiarism, thus, becomes cardinally important. Online materials are increasingly becoming more stringently scrutinized for the infringement of copyright.

6. Conclusion

Millennial students are generally more ready to embrace new technologies than their professors, and are more willing to adapt to new technologies. As a result, they are also pushing, and perhaps challenging, faculty to expand their technical competence, especially in new or emerging technology such as podcast. In this paper, the author shares his experience of employing video podcast in teaching engineering courses, both at graduate and undergraduate level with class size ranging from 20 to 60 students. Based on the survey and assessment, it is found that such technology can provide us with an important tool for the delivery of course contents in order to enhance the learning experience of students. Furthermore, students will feel empowered to learn with technology and be comfortable with, and capable of excelling in, diverse learning environment with various tools and technologies. Survey was conducted with outcome-based assessment. The results suggested that students were able to enjoy enhanced learning experience and outcomes.

7. Acknowledgment

The author would like to thank the technical supports of the College of Engineering and Applied Sciences (CEAS) at the Stony Brook University (SUNY). Without the facility and infrastructure, this study and implementation of podcast technology would not have been possible. Specifically, Mr. Yersson Gaona has been instrumental in making possible the recording and production of video podcasting for the classes and contents of podcasting described in this paper. Ms. Jennifer Adams manages the University podcast server on which the contents of the classes are published and maintained. This teaching project was also partly supported by a NSF grant CMS 0428403.

References

- [1] Wikipedia, URL address: <http://en.wikipedia.org/wiki/Podcasting>.
- [2] Apple, Inc., "Podcasting Frequently Asked Questions (FAQ)," <http://docs.info.apple.com/article.html?artnum=301880>
- [3] Miller, David B., "Podcasting at the University of Connecticut: Enhancing the Educational Experience," *Campus Technology*, 10/16/2006, <http://campustechnology.com/articles/41255/>
- [4] Read, Brock, "How to Podcast Campus Lectures: Advice on getting your institution's 'coursecasting' program off to a good start," *The Chronicle of Higher Education*, Volume 53, Issue 21, Page A32, January 26, 2007
- [5] Keough, Mark, "Relationships not technology are the keys to Online Learning," Archer College, <http://unisa.edu.au/>
- [6] Bongey, Sarah B., Cizadlo, Gerald, and Kalnbach, Lynn "Explorations in course-casting: podcasts in higher education," *Campus-Wide Information Systems*, Volume 23, Issue 5, pp 350 – 367, 2006
- [7] Brattain, W., 1968. "Genesis of the Transistor." *The Physics Teacher*, March, pp. 109–114.
- [8] Riordan, 1998. "The Road to Silicon Was Paved with Germanium." In H. R. Huff *et al.*, eds., *Semiconductor/Silicon 1998*. Pennington, NJ: The Electrochemical Society, pp. 99–108.

- [9] Stony Brook University Copyright policy, “The Teach Act: Fair Use and Copyright Protection for Digital Media,”
<http://www.stonybrook.edu/provost/facultyinfo/teachact.shtml>
- [10] I. Kao, “Making Video Podcast Lectures in Modules,” Teaching, Learning, and Technology (TLT) workshop, January 2008, Stony Brook University