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Audioblogging in Undergraduate Materials Education

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Abstract

A Materials Engineering course was developed to include the use of audioblogs (aka 'podcasts') for student projects. The objective of student projects in the course (website or podcast) is to describe a materials selection problem and solution. Podcasts that were submitted for the course were audio files containing a description of a materials problem, project or topic. Podcasts were graded on format, relevancy, quality and accuracy. All students were required to listen to several podcasts. All submitted podcasts were broadcast on the campus radio station during the weekly Metal Hour radio show. The paper summarizes topics that were selected and proposes recommendations for future offerings of the Podcast option in Materials Engineering courses.

Key Words: Podcasts, Audioblogging, Materials Engineering Instruction, Radio Programs

Introduction

Audioblogs and live radio have been used in Materials Engineering instruction since at least 2001 [1]. The use of audioblogs and podcasts is gaining popularity as demonstrated by a google search on the topic [2-5]. At least five active websites have been developed in 2007 that offer podcasts providing about materials topics. Additionally, ASM International has launched a national podcast competition for collegiate Materials Advantage chapters [6]. In the competition, collegiate chapters develop podcasts with the specific intent of providing materials instruction to middle schoolers.

A collegiate radio show has been broadcast since 2001 with the objective of providing materials commentary to the local community [7]. The radio show encourages students to listen and call in questions about materials.

Materials Engineering (ME328) at Rose-Hulman is a required course for students enrolled in the Mechanical Engineering curriculum. The course is taught as a lecture-only course, four days a week during 50 minute periods. The course is taught during a ten week quarter. To accomondate approximately 160 students, six sections of the course are offered with approximately 28 students in each section. Nearly all students enrolled in the course are Mechanical Engineering majors, and are nominally of junior status.

Because the course is populated by Mechanical Engineering undergraduate students, the course topics tend to emphasize concepts that are relevant to mechanical systems. Course topics include

an emphasis on properties, manufacturing, ceramics, polymers, composites, thermomechanical processing, phase transformation and corrosion. Course topics that are underemphasized include diffusion, electrical, optical and magnetic properties of materials, electron orbitals, lattice and crystal structures.

The listed course topics include:

- Mechanical Properties of Metals
- Failure: Fracture
- Failure: Fatigue
- Dislocations, Slip and Plastic Deformation
- Mechanisms of Strengthening in Metals
- Recovery, Recrystallization and Grain Growth
- Phase Diagrams
- The Iron-Carbon System
- Microstructural Changes in Fe-C Alloys
- Ferrous Alloys
- Nonferrous Alloys
- Metal Fabrication and Welding
- Thermal Processing
- Ceramic Structures and Properties
- Applications and Processing of Ceramics
- Polymer Structure
- Mechanical Properties of Polymers
- Polymer Processing
- Composites
- Corrosion
- Degradation of Polymers
- Material Selection

The text used in the course is Callister, *Materials Science and Engineering, An Introduction*, Wiley [8].

The Materials Engineering course primarily addresses ABET Criteria a, e, and k. According to ABET [9], the criteria are as follows:

a. an ability to apply knowledge of science, mathematics and engineering
b. an ability to design and conduct experiments, as well as an ability to analyze and interpret data
c. an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate and solve engineering problems
f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Grades for students are based on nine quizzes, one final exam and a project. The quizzes are given once per week and are approximately twenty minutes in duration. The final exam is a four-hour, closed-book written exam requiring approximately two to three hours of time. The project consists of participation in a team in the investigation of a materials topic or materials selection problem. Grading in ME328 is based on the final exam (30%), quizzes (50%) and the project (20%).

The project is assigned at the beginning of the quarter, and students are encouraged to use the entire ten weeks to develop their project deliverable (e.g. website or podcast). Students that select the podcast option are required to submit interim deliverables to ensure that their project is progressing.

The purpose of the project in the course is to reinforce topics that are covered in the lectures. The project allows students to study an area of personal interest and to participate in an open-ended materials selection problem. Students also benefit from working in teams. Examples of materials selection problems that have been presented in a poster format include: materials selection criteria for golf club shafts, and material selection criteria for aircraft wings for fighter aircraft.

Students are required to evaluate other projects. Students that create websites and required to evaluate other student-created websites, and students that create podcasts are required to listen to other podcasts. For either project type, students are required to submit a list of references. The list of references must include the student's evaluation of the source. Since many of the sources are from the internet, the students were instructed to evaluate their sources according to four evaluation criteria:

Authoritative
Quantitative
Unbiased
Thorough

In each of the four evaluation criteria listed above, students were asked to rank their sources using a numerical scale. By requiring students to rank each source in each of the four categories, students may consider the credibility of sources in future projects.

Podcasts from the Materials Engineering Course

Table 1 summarizes the podcasts that were submitted in the two most recent academic years. The data in Table 2 indicates that traditional materials topics such as tire manufacturing, stainless steel, aluminum, coins, etc. continue to generate interest. The data also shows that relatively new and high-tech materials topics such as trabecular metal and solar energy are also interesting to students. The wide range of topics demonstrates the large interest range for a diverse group of mechanical engineering students.

Table 1. Podcast topics from Materials Engineering

AUTHOR	YEAR	TOPIC
S. Dick. L. Farr	AY0506	trabecular metal
T. Roberts, M. Shepard	AY0506	tire rubber and manufacturing
M. Boyer, M. Gough	AY0506	high performance turbochargers
S. Sawusch, N. Schmidt	AY0506	superalloys
M. Sharp, M. Richardson	AY0506	alloys in musical instruments
B. Couch, J. Rhoades	AY0506	stainless steel
K. Grubbs, S. Hollingsworth	AY0506	golf club heads
P. Meiser	AY0506	general interest
J. Jackson	AY0506	induction melting
T. Butler, F. Webber	AY0506	metallurgical processes in antiquity
D. DeVirgilio	AY0506	magnesium alloys
S. Graber, M. Snellenberger	AY0607	buckyballs
B. Lauer, S. Story	AY0607	exotic alloys
M. Morris, D. Weigel, H. Young	AY0607	aluminum processing
E. Clifft, E. Volz	AY0607	solar energy
J. Kennedy	AY0607	coins
E. Rumley, C. Williams, S. Yoder	AY0607	D30

Table 2 shows information that was provided to students who selected the podcast project in ME328 during academic year 2006/2007 (AY0607).

Table 2 Podcast requirements for Materials Engineering students

Objective: The objective of the podcast project is to get students to study a materials-related issue of their own choosing, and to package their results in a creative format suitable for audio broadcast.
Deliverable from students: 1. CD with a minimum of 45 minutes of content, including at least two speaking segments that total to at least 10 minutes. The balance of the time on the CD may be comprised of music of the students choosing. 2. Playlist that indicates the content of the CD.

3. Written summary of the materials topic. The written summary should be two pages maximum. The format of the summary is not critical and a bulleted summary is ok. Dr. Ferro will probably use this information on live radio broadcasts, so please be generous with your info! Thanks.

4. You must listen to another student's or student team's CD project, or listen to the Metal Hour and complete a questionnaire. The questionnaire will ask questions about your experiences and about the other show you listened to.

Guidelines: Select a topic of interest and read about it. Use the web, use the library and talk to professors to get more info. Take copious notes and type them up. Use the notes for item (3) above.

Record songs on a CD in any order, in the same general format as a typical radio show. After a few songs, break in and speak freely about your materials topic. Be upbeat and create interest. Play some more music and return to the topic, or start a new topic. Make sure the content of the CD is positive and interesting.

It is ok to do this in project teams, with teams of not more than two students.

The estimated amount of time spent on this project should be approximately six hours, of which approximately three hours should be spent researching the materials topic and taking good notes. Two hours should be spent preparing the CD. Another hour is allocated for listening to another CD or Metal Hour show. Please keep track of your actual hours spent working on the project, as you will be asked this question on the questionnaire at the end of the project.

Grading:

A Great topic, creatively expressed, all deliverables completed, professional
B Great topic, all deliverables completed, lacking professional appearance
C Some deliverables missing, and/or sloppy work

Students who participated in the Podcast project were required to complete a questionnaire about their experience. The questionnaire is shown in Table 3.

Table 3. Podcast participant questionnaire

Listen to another group's podcast. Make sure you time the spoken portion of the podcast accurately. This questionnaire and your answers will remain confidential. Evaluate the

podcast you listened to in three categories: 1. Audit it to the rules of the podcast assignment. How long was the spoken portion of the podcast? How long was the musical portion? Was it entertaining and informative? 2. Evaluate it for its ability to communicate meaningful information about materials. Did you learn more? Did it reinforce existing knowledge? As you do this section, compare the podcast against if the same topic would have been covered in a poster project format. 3. Evaluate the podcast for its artistic content. Is it fun to listen to? Could you tell if the participant had fun making it? Would the podcast be a good replacement for the poster session because it is more fun to make?

What was the technical topic of the podcast?	
New information you learned (it is ok to answer nothing')	
Questions you have now after listening to it (it is ok to answer nothing')	
Suggestions for the group	

Was the music good?	
Was it eclectic or all the same genre?	
Other comments:	

Table 4 summarizes examples of student comments from submitted questionnaires. The comments are generally positive. From the comments, two general conclusions may be made:

1. Students enjoy presenting the results of research in podcasts,
2. Students enjoy listening to research results from other podcasts.

Table 4. Example student comments on the podcast project

I really like the podcast project. (We) learned much more through this medium that we would have by creating a traditional poster (or website). I had fun doing this project!
It was a great project. I enjoyed learning about a material and then presenting it in an enjoyable manner.
Liked it, a different way to present info on materials.
I really liked it. It allowed us to use a different media to learn and it broke the mold of normal

things.
I enjoyed listening. It was a good way to incorporate new material in a fun, interactive method. I learned a lot more than I already knew and had fun listening to the music.
I really enjoyed working on the podcast. We did a lot of research and learned a great deal, but instead of a mundane report or poster, we were able to do something more creative. For other podcasts, (sometimes) it was a bit hard to hear the facts but the songs broke up the info to keep interest.
I really liked this project, it was actually fun to do. Yet we will did the research and learned a lot about our topic. Its a very creative idea and a nice break from the normal project requirements.
I think its a great idea. It is somewhat challenging to get 12 minutes of oral content. It is nice to have a completely different type of project.
This was a fun project. It was enjoyable to put together and fun to listen to.
The podcast is great! Of all the projects I've done here this one is near the top of the list. It was unique, allowed us to be creative and was a wonderful change of pace.
It really gave me a chance to research a new and interesting topic, and to talk about it. Explaining what it was that we learned, especially about the properties, reinforced what I had learned during lectures. I will always remember the information! It was awesome!
I think its a great idea.
I liked the podcast idea. Its nice to change the way we present our research. It gets old writing reports and making posters (and websites), and I imagine it get old grading the same thing over and over.
I like the idea of a podcast. I think it is a nice way of presenting information instead of writing it in a report.

Participation in the podcast project also indicates that the course attempts to meet ABET criteria (g) on developing students' respective abilities to communicate effectively.

Podcasts that were created by students in the ME328 course were played on-air during the Metal Hour radio program. The Metal Hour is a weekly radio program that allows for discussion of materials topics [7].

Recommendations for future course offerings

The podcast project will be used again in academic year 2007/08 (AY0708) in the Materials Engineering course at Rose-Hulman. The podcast project will be run similarly to the previous academic year with the following changes:

1. The podcasts will be posted to allow access by all Materials Engineering students enrolled in ME328,

2. The podcasts will be uploaded to a directory, and each podcast will be linked to the playlist file for that podcast.

3. Feedback from listeners will be quantified and given to the podcast creators.

Conclusions

Podcasts may be used in Materials Engineering courses to allow for a different way of presenting research results. Students comments indidcate that students enjoy listening to other podcasts, and that information learned from podcasts may reinforce course topics.

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