Using Student-Produced Videos to Enhance Learning Engagement in a Chemical Engineering Thermodynamics Course

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Overview

• Background – Genesis of idea
• Initial trial
• Assignment
• Student response
• Examples of student videos
  – Little of no voice over
  – Voice over slides
  – Animated
  – “Student Actors”
Genesis of the Idea

• Daughter’s Chemistry class
  – “Chemistry for Poets”
  – Created a video in place of a term paper about some chemical

• Hazardous Materials Course
  – Term paper on hazmat scenario in Rolla area
    • Student would prepare paper and give presentation to class
  – Gave the students the option to replace PowerPoint presentation with a video about their scenario
Hazmat Video Project

- Elective course so students were generally interested in topic
- Video assignment option given after the first of semester. Groups could opt out of video production
- All groups in the class choose to prepare a video
- I gave little (no) help on how to create video
  - Student able to figure out on their own
  - Created in different formats
- Response from students was very positive.
Thermodynamics

• Required 2\textsuperscript{nd} year course
  – ChE majors and some EnvE majors
• Thermodynamics typically viewed by students as a fairly “dry” topic
• Formula intensive and calculation intensive topic

• How to adopt video project?
Thermo Video Project - Overview

• Allowed class to divide into three member groups.
• Students choose topics – they were posted to minimize overlap of topics between groups
• Viewed videos during last week of class (dead week)
• Graded with rubric by instructor, GTA and five classmates
Assignment – Create a Video:

• Research, summarize, teach and give a real world example of some concept associated with:
  – Mathematical description of the state of material
  – Mathematical estimation of thermophysical properties
  – Applications of the first and/or second law of thermodynamics
  – Volumetric properties of pure fluids
  – Thermodynamic properties of fluids
  – Heat effects of processes
Project Assignment Specifics

- “You Tube” format – less than 10 minutes
- Introduction include
  - Missouri S&T
  - Title
  - Student’s names
Project Assignment Specifics – cont.

• The video can consist of:
  – Pictures or videos of processing equipment
  – PowerPoint slides with voice over
  – Chalk/white board presentation
  – Talking head
  – Demonstration
  – etc, or some combination of all
Project Assignment Specifics – cont.

• Central idea
  – Present some thermodynamic concept or calculation related to chemical process equipment
  – Teach about it and demonstrate it in a format so that future students can access the video to learn more about the concept.
## Grading Rubric

### ChBE 141 – Chemical Engineering Thermodynamics I

#### Video Presentation Grading Rubric

**Concept:** ________________________________ **Score:** ______

**Group Members:** __________________________

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and concept description</td>
<td>Little of no introduction of concept or calculation, minimal motivation of need or application</td>
<td>Poorly defined concept or calculation, minimal background and motivation of need or application</td>
<td>Complete introduction of the concept and motivation and need for the application</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thermodynamic Principles</th>
<th>Little or no description of the thermodynamic principles involved</th>
<th>Description of the thermodynamic principles involved</th>
<th>Complete description of the thermodynamic principles involved</th>
</tr>
</thead>
</table>

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### Missouri University of Science and Technology

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# Grading Rubric – cont.

## Presentation and organization

<table>
<thead>
<tr>
<th>Presentation Organization</th>
<th>Poor organization, repetition or omission, rambling or overly terse, no connection among different parts</th>
<th>Acceptable organization, each section generally appropriate length, adequate linkage between parts</th>
<th>Well organized presentation, structure is logical and evident to listener. Linkages evident</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Approach</strong></td>
<td>Superficial or little technical understanding of material presented</td>
<td>A general understanding of technical aspects of the material presented</td>
<td>Clear understanding of the technical aspects of the material presented</td>
</tr>
<tr>
<td><strong>Presentation Style &amp; entertainment</strong></td>
<td>Speaker(s) poorly prepared; excessive pauses, filler words, and colloquial speech; poor visual aids</td>
<td>Acceptable presentation style with few pauses; appropriately technical speech; good visual aids; effective and professional speaking style</td>
<td>Excellent presentation style; highly professional speaking and well prepared visual aids. Entertaining</td>
</tr>
</tbody>
</table>

| Evaluator’s Name: |  | | |
Fall 2011

- Forty-two students enrolled
- Fourteen videos produced
- Viewed over three class periods

- Different levels of quality and content
- Performed anonymous survey to gauge students’ opinion of the video project
Survey Results

• Students asked to rate: 0-Strongly Disagree to 4-Strongly Agree
• Questions about whether students enjoyed doing the video or thought it was a waste of time
• Questions about whether having the videos available on-line (Blackboard) would be useful
• Questions about whether they felt they would learn more without the videos
Survey Results – Student Interest

• “Dr. Ludlow should continue to assign the video production project”
  – $3.3 \pm 0.8$

• “I enjoyed watching the videos prepared by my classmates”
  – $3.1 \pm 0.8$

• “I thought watching the videos in class was a waste of valuable classroom time”
  – $0.95 \pm 0.96$
Survey Results – Availability online

• “Having had the videos available on Blackboard for review during the semester could have aided in my learning”
  – 2.8 ± 1.0

• “I felt like I could learn something by viewing and reviewing the videos prepared by my classmates”
  – 2.7 ± 0.9
Survey Results – Student Learning

• “I feel that I would have gained more knowledge from completing a research paper project rather than doing the video project”
  – 1.0 ± 1.0

• “I feel that the video project helped me to better learn some concepts of thermodynamics”
  – 2.9 ± 0.9
Survey Results

• “How could this video project assignment be improved?”
  – A few more guidelines – suggested resources
  – Set minimum time and also lower maximum time (9 – 10 minute videos seemed too long)
  – Wanted available on Blackboard (even though none had been produced yet)
  – Allow all class to grade each video
  – Numerous responses – noting that it was a fun and great assignment
Survey Results

• “I believe the following should NOT be part of the video project”
  – Allowing more than one group to cover a topic
  – Allowing students to not be in the video (entirely voice over of pictures)
  – Most of the responses indicated that nothing should be changed and they enjoyed the project
Videos with little or no talk

• From survey and student grading, this type of video was not received as well.
• Still the video is informative

Video “Sensible&LatentHeat”
Videos with Voice Over

- Some groups created videos using primarily PowerPoint slides, pictures or video clips

△ Video “CoalFiredPowerPlant”
△ Video “CubicEOS”
Animation

- One group completed their video entirely as an animation.

- Some student survey comments felt this was a “cop out” since the participants were not on video

△ Video “IdealGasProcesses”
Videos with Student Actors

• Some groups created entire video with live actors.
• In some cases created parodies of popular TV shows.
• These type of videos received more positive comments and were graded higher by the student peers.

△ ThermoOfPizza
△ DippyBird
Current Status

- Spring Semester – 63 students – 21 teams
- Planning on using clickers to allow entire class evaluate each video
- Updated suggested resource list, including Camtasia Studio available in one CLC on campus
Summary

- Using student generated videos to convey thermodynamic concepts
  - Enhanced student engagement in learning thermodynamic principles?
    - Definite yes
  - Enhanced student learning?
    - Haven’t quantified this yet
Thank You

- Acknowledge the support of CERTI at Missouri S&T for encouraging this project.