Student-created YouTube Videos: A Multimedia Assignment to Foster Active Learning in a Large Engineering Classroom

MICHIGAN ENGINEERING
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Andrew Zak, Luke Bugada, Fei Wen PhD
Department of Chemical Engineering, University of Michigan

Project Motivation

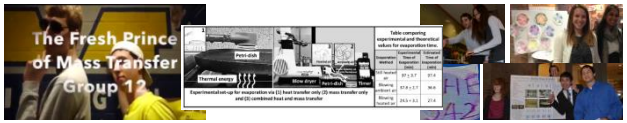
Although students are intuitively familiar with the principles of mass and heat transfer in everyday phenomena and demonstrate great comprehension of difficult concepts (the "layman" approach), they often fail to take full advantage of this learning method when confronted with a more deductive teaching style proceeding from the general principles to equations to practical applications (the "scientific" approach). One way to address this limitation of traditional classroom-assignment learning is through the use of a project-based learning approach, one of several commonly used active learning strategies. Given the current generation's technological proclivity, we decided to enhance our ChE 342 Mass and Heat Transfer project by incorporating a YouTube video component, thereby strengthening a project-based learning approach with a digital media platform.

How does incorporating a video component to a group project impact student learning?

Pilot: YouTube Video Project

The YouTube Video project was implemented in the 2014 Fall Semester for a large (150 student) junior level mass and heat transfer course (ChE 342). Groups of 4-5 students were tasked with creating a real-life demonstration or simulation of a mass and/or heat transfer concept that was appropriate for a high school level classroom and public audience. Students were limited to a budget of $25 thus encouraging the use of everyday materials that could be easily adapted and used in a high school classroom.

Project Deliverables



3-5 minute YouTube video **5 page written report** **Poster presentation with live demonstration**

YouTube Channel: The Fun of Mass and Heat Transfer

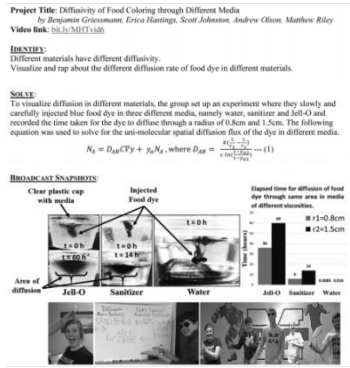
https://www.youtube.com/channel/UCBpw-AyX_Sw8EVsKObSiUVw

Large Classroom Logistics

To facilitate the feedback for proposals from more than 30 groups, an Excel spreadsheet on Google Docs was utilized. Students could enter their proposal, receive comments from instructors, and refine their proposal in order to receive approval in a timely manner.

#	Brief proposal	Instructor Feedback	Student Revisions	Status
7	We want to demonstrate the effect of heat transfer of different cooking materials. To do this, we will compile pans of different materials of approximately same thickness and make pancakes. The burner would be on for a few minutes, and the pan at room temperature. Immediately after putting the pan onto the stove, we would pour a predetermined amount of pancake batter into the pan, and cook it for the same amount of time per side for each type of pan. Our goal is to be able to measure the relative conductivity (k) of the materials by the darkness of the pancakes. Our format will be a cooking show style.	How different are the k values for these materials? This will determine whether or not you will be able to observe differences in pancake color	Material – k value 1. teflon - 0.25 W/mK, 2. copper - 385 W/mK, 3. cast iron - 65 W/mK, 4. teflon aluminum alloy - to be determined experimentally	Approved. Be sure to focus on "Wow Factor" in your cooking show

Identify – Solve – Broadcast

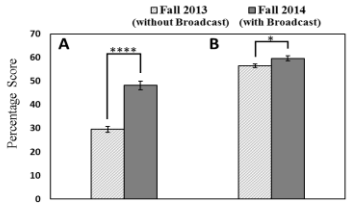


Identify
Students were first required to write and defend a proposal with a particular emphasis on scientific accuracy and feasibility

Solve
Students designed original experiments or simulations, defining the relevant parameters for their system

Broadcast
Students communicated their work in an engaging way, often incorporating musical and theatrical elements in their YouTube video

Impact on Student Performance



Wen, F. Chem. Engr. Education, 50(3): 186-192 (2016).

Student performance was assessed in years with (Fall 2014) and without (Fall 2013) the YouTube video component as part of the group project. Students in the Fall 2014 class with the YouTube video performed significantly better on a control mass transfer question and on the final exam as a whole compared to the Fall 2013 students.

Under the Identify-Solve-Broadcast model approach, we identified several major contributing factors that we believe led to the overall successfulness of this project. In order to determine the role each contributing factor played as part of the student experience, a group of 10 students from the Fall 2014 ChE 342 class, each from different groups, participated in a post-survey and focus group discussion.

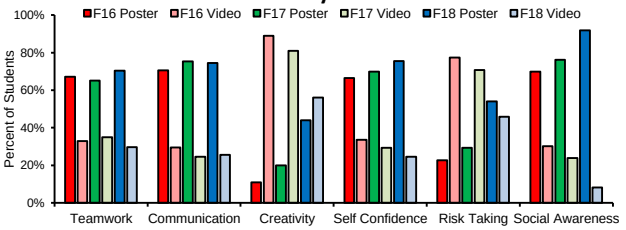
How does the mode of presentation impact the contributing factors to improved student learning outcomes?

Fall 2016-2018 Projects

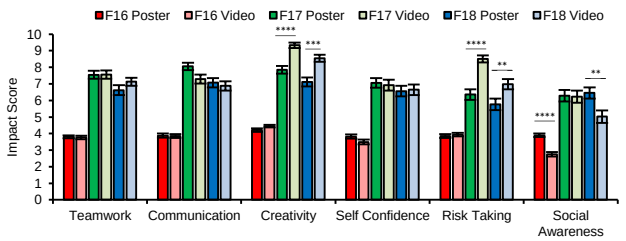
Based on the post-survey and focus group data, we refined our original research question and devised a new format that would allow us to elucidate which contributing factors were more or less associated with each mode of presentation. For the Fall 2016-2018 projects, groups could choose between a live poster presentation or a YouTube video.

Live Presentation	Video
• 15 minute poster presentation • Live demonstration	• 4-6 minute YouTube video • 5 page written report

Pre-Survey Results



Post-Survey Results



Impact scale (F16): 0-5 ; Impact Scale (F17-F18): 0-10 (0 – none, 2 – slight, 5 – moderate, 8 – significant, and 10 – great)
Statistical analysis was performed using unpaired Student's *t* test. All data are represented as the mean of three independent experiments and error bars represent the standard error of mean (SE). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ****$p < 0.0001$.

Poster Feedback

"I liked the fact that the poster format of the assignment allowed me to practice my soft skills in addition to technical skills."

"I found that delivering the poster presentation was really helpful in furthering both my understanding of the concept as well as the understanding of the people I was teaching, as they could ask questions, and I would have to really think about how I was presenting the information. I find that feedback is always beneficial for both parties."

"I felt that the poster presentation was a very worthwhile endeavor. It certainly helped my improvising skills, and my ability to think quickly under pressure. Along with this, sometimes I don't feel that we have enough practice vocalizing what we know as engineers, so this really allowed us to do that."

Video Feedback

"Personally, I really enjoyed making the video. I had a lot of fun coming up with the idea, writing the script, filming, and editing the video."

"I thought the video was a great way to display creativity and it gave my group the opportunity to do an experiment that would have taken too long to demonstrate in person."

"I liked being able to be creative and create a storyline based around a heat transfer problem. It made the project much more interesting than just merely running an experiment."

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