

IMPROVING COMMUNICATION SKILLS THROUGH STUDENT-PRODUCED VIDEOS

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Introduction

Most mathematics instructors would agree that a student's journey towards a problem's solution is often more important to the student's learning than the particular solution he or she finds. This paper presents a method for students to communicate this journey through video. The paper describes video essay assignments in which students are asked to create and narrate a screencast that addresses a certain problem in the course. In the paper I will first review two freely available screencast programs and discuss the technical issues of introducing the software to students. Then I will discuss how the projects were implemented in both a business calculus and modern algebra course. I will include a discussion of assessment for both courses, including summative assessment of the videos and formative assessment of the projects as teaching tools.

Software Review

When searching for screencast software I used two main criteria: cost and ease of use. I wanted to find software that would be free to my students and that would limit the number of technical issues my students would face. In this section I present two free programs that I believe are particularly user friendly. The first, *Jing*, is a downloadable program created by Techsmith, the makers of *Camtasia*, while the second, *Screencast-O-Matic*, allows for web-based recording without downloading any software.

Jing – <http://www.techsmith.com/jing.html> – can be downloaded for free. After a quick installation, the *Jing* sun icon appears in the top right corner of your screen. Simply click on the icon, outline the portion of your screen you would like to begin recording, choose

capture view, and begin recording. *Jing* will capture up to five minutes of video. When you are finished recording you can download the video as a shockwave flash (swf) file or you can save the file to Techsmith's own storage site, screencast.com, where each registered user has up to 2 free gigabytes of storage. If you choose to post the file to screencast.com, *Jing* automatically puts the recording's url on your computer's clipboard. You can then easily paste the url into a document, e-mail, webpage, etc. The recording is clear and *Jing*'s watermark, a one inch banner at the top of the video, is not distracting.

I chose to suggest *Jing* for my business calculus video essay assignments. I spent about 15 minutes on the first day of class introducing *Jing* and provided a handout that is available on the software's website. Each of my students created an account with screencast.com at that time. The students pasted the url for their video essays as part of an online homework assignment and I could view their video essays by simply clicking on the links they provided. With only fifteen minutes devoted to the technical details of creating and distributing the video essays, I expected some technical issues to arise and planned on dealing with them in a one-on-one manner. However, to my surprise, no technical issues arose during the entire course of the semester.

Screencast-O-Matic, <http://www.screencast-o-matic.com>, is a java-based application that can be run from the website without downloading additional software. When the website is accessed, a bright "start recording now" button is visible. Simply press the button, adjust the size of the recorded area, and begin recording the video. *Screencast-O-Matic* has a 15 minute limit for video recordings. When your recording is finished you can publish the video to *Screencast-O-Matic*'s host site, publish the video to *YouTube*, or publish the video to a file: quicktime (mp4), window's media (avi), flash (flv) or animated image (gif). *Screencast-O-Matic* has the added bonus of capturing both screen and web-cam images as well as showing a mouse halo and mouse clicks. This software's ability to create a video with picture in picture and lengthy recording time make it a wonderful option for more involved projects. However, I believe *Screencast-O-Matic*'s storage site is not as easy to use as the one tied to *Jing* and thus I prefer *Jing* for smaller, more regular assignments.

I will end this section with another antidote illustrating how easily my students interacted with this software. I included a video assignment as part of a final project in a modern algebra class. I simply posted links to the *Jing* and *Screencast-O-Matic* websites on the assignment link and did not spend a minute of class time addressing the technical details of creating a video recording. I asked the students to save their video as a mp4, flv, or swf file and upload it to an assignment link on our course website. Some students chose *Jing* while others chose *Screencast-O-Matic* and again I did not face a single technical issue related to this assignment.

Video Essays in Business Calculus

My interactions with Appalachian State University's business calculus course motivated me to explore video essay assignments. Several years ago our business calculus course was re-designed to focus more on concepts and less on computation. As a result, we asked students to use Excel and a Computer Algebra System (CAS) to do most of the computational work in the course. Therefore, students would often submit very brief solutions to their homework problems. This issue was exacerbated when I began to use Wolfram Alpha instead of Maple for the CAS in the course. Previously, I could ask the students to submit their Maple file, but getting a clear picture of the method a student used to solve a problem was more difficult with the web-based Wolfram Alpha. I decided that by assigning video essays I could watch the students complete the problems while listening to them explain their processes.

My first video essay assignments were short five-minute videos in which students were asked to create a screencast of their progress towards a solution to a specific homework problem. The students were to narrate the screencast, pointing out the important aspects of their work. I hoped that while narrating the screencasts the students would think about what they were doing to solve the problem and why this was the correct process. This deeper connection with the material would help the students to understand the concepts more clearly.

Each week the business calculus students completed a short (approximately six question) on-line homework assignment and the last question in each assignment was a video essay problem. The students simply posted links to their video essays as their solutions to this problem. One of the first topics we address in business calculus is the idea of modeling data using Excel. The video essay for this topic read as follows.

The following table gives data concerning fatalities in crashes and fatalities in crashes due to distracted driving in the United States for the years 2005-2009.¹

years since 2000	Fatalities in crashes	Fatalities in crashes involving distracted driving
5	43543	4572
6	42568	5917
7	41014	5988
8	37152	5870
9	33808	5474

(1) Create a good graph of the PERCENTAGE of overall crash fatalities that were the result of distracted driving vs. the year. (2) Add an appropriate trend-

¹The 2005-2008 data is from [1]; the 2009 data is from <http://www.nhtsa.gov/FARS> ; data beyond 2009 cannot be compared to previous data due to changes in the way distracted driving is categorized by the national highway traffic safety administration.

line to your data (include the equation of the trendline on your graph). Describe the general trend of the data in the context of the problem and give a justification for your choice of function to describe the trend in the data. Are you confident that your trendline does a good job of modeling the data? Explain. (3) Use your trendline to estimate the percentage of crash fatalities that will be the result of distracted driving this year. (4) Are you confident that your trendline will do an accurate job of predicting the percentage of crash fatalities due to distracted driving well into the future? Explain.

I tried to create video essay questions that asked students to practice the technical skills they had learned and to think critically about the results they found. In this problem the students practiced the technical skills of entering formulas, creating a scatter plot, and adding a trendline in Excel. However, the question involved more than simple technical skills. I chose the data to be ambiguous enough (only 5 years of data for a problem that has been around much longer) that the students may question their trendline. I also wanted the data to be in some way relevant to the students so that they were more likely to have reasonable interpretations of the trendline, its meaning, and its value.

I graded each essay on accuracy (5-points) comprehensiveness (4-points) and organization (2-points). I feel that the students took the video essay problems seriously. Most of the questions I answered during office hours pertained to the video essay problems. I think the fact that the students had to narrate their solution made the students feel more responsible for their work and am confident that the students learned as much through these assignments as they would through traditional written work. While each essay was at most five minutes in length, I must admit that grading an entire class of essays took me several hours.

I believe that the most valuable outcome of the video essay assignments was what I learned about my students' perceptions of business calculus. I enjoy teaching business calculus because using technology for the computations allows our class to talk about more meaningful problems and explore the ideas of calculus applied to situations in the business world. When I began to watch the video essays I learned that my students did not view our course the same way that I did. More often than not students still focused on the computation, replacing a list of formulas to be simplified with a list of clicks in Excel or Wolfram Alpha. They had replaced by-hand computation with software, but their focus was still on the how and not at all on the why. Before assigning the video essays I suspected that students would struggle most with explaining concepts, but the extent to which the students focused their narration on computation in lieu of concept was still surprising to me. The essays did improved throughout the semester as students received feedback on their previous work. By the end of the semester the students at least realized that the assignments were as much about explaining why a particular method worked as they were about arriving at a correct solution.

Video Essays in Modern Algebra

After my somewhat successful everyday use of video essays in business calculus, I decided to use student-produced videos as a component in a modern algebra final project assignment. For the project students worked in groups of 3-4 students. I gave the students a list of fourteen recent papers published in accessible journals (e.g. *Mathematics Magazine*, *College Math Journal*). Each paper was an extension, application, or history of the concepts we had learned in class. After choosing a paper the groups created a list of the topics in the paper that we had touched upon in our class. They annotated the list with a description of how each topic related to the article as well as two rankings: a ranking of the importance of the topic to the article and a ranking of the group's confidence in the topic. After reading the lists of topics with their rankings, I assigned a topic to each group. The groups then created short videos introducing the key ideas of the topic they had been assigned. I posted the videos for the entire class to review and comment upon. For the final project the student's showed the final version of their videos and then gave a brief presentation about how the topic reviewed in the video was important to the results of the paper they had chosen.

For example, one group chose Jean Nganou's "How Rare Are Subgroups of Index 2?" [1]. The students identified Lagrange's theorem as a topic from our class that was important to this paper. They created a wonderful video reviewing the statement and idea of the proof of Lagrange's theorem as well as several important corollaries. They ended by showing that A_4 , a group of order 12, has no subgroup of index 2, i.e. no subgroup of order 6, as a counterexample to the converse of Lagrange's theorem. Their in-class presentation was also excellent, extending the ideas from the video to a discussion of subgroups of index 2 in general groups of even order, bringing together ideas from modern and linear algebra in the process. I have heard from several of my former students that they enjoyed the project and that making the videos helped them to see how the articles were grounded in the basic ideas of modern algebra that we had discussed in class.

This one-time project was more intensive than any one of the business calculus videos and thus the assessment was more complicated. Looking for correct computations, thorough explanations, and a clear logical process, I graded the students first drafts of the videos on a 6-point scale. The students then received feedback from myself and their peers and I graded the final versions of the videos together with the presentations using the criteria of accuracy, comprehensiveness, and organization (15 points). While I graded each video twice, the fact that the students worked in groups minimized the number of videos I needed to watch and grading the videos did not seem burdensome.

While I had planned the projects as a way for students to solidify their knowledge of modern algebra, the projects also served as window into my students view of the subject. Just as in business calculus, most videos (with the exception of the Lagrange's theorem video mentioned previously) focused on computation and many of the explanations were not clear

or even technically correct. I was surprised to see how much my students viewed modern algebra, a course that is to me all about theory, as a procedural subject. I had planned on posting the videos for future classes to review, but even after the groups made corrections for their final draft, only the Lagrange theorem video was of high enough quality to post. I believe that my students had a quality learning experience during the course of this project, but I wish that I had assigned a similar project at mid-term so that I had time to address the weaknesses that I found after the videos were completed.

Conclusions

I believe both my students and my teaching benefited from the video essay assignments. The assignments asked the students to create a dynamic solution to a problem and forced the students to think about what they felt is important to the solution and to talk about these important ideas as they narrated the videos. My teaching benefited as I developed a clearer understanding of what my students believe is important to the subject. In both modern algebra and business calculus the videos taught me that my students view doing mathematics as applying a memorized procedure, which has caused me to change the way I teach. I focus more on concepts in class and my quizzes and exams reflect this fact. I hope that as I continue to implement the video assignments in my classroom I will see the changes I have made in my teaching reflected in the students' narrations as they explain their solutions to the video essay problems.

References

- [1] Jean B. Nganou. "How Rare Are Subgroups of Index 2?" *Mathematics Magazine* 85.3 (2012): 215-220.
- [2] Wilson, Fernando A., and Jim P. Stimpson. "Trends in fatalities from distracted driving in the United States, 1999 to 2008." *American Journal of Public Health* 100.11 (2010): 2213-2219.