Saving Time In and Out of Class: Video Exam Solutions

Christi Patton Luks, Missouri University of Science & Technology

Abstract

Demands on faculty time seem to be increasing year after year. Technology has proven to be both friend and foe in meeting our goals. This paper presents one instructor's attempt to reduce time spent in class and in one-on-one sessions with students using video solutions to exams. Posting solutions to individual problems as well as written solutions has tremendously reduced the number of questions about grading and has been well-received by students as a review tool for final exams.

Introduction

Year after year, faculty are pressured to remove hours from the curriculum while increasing content in the curriculum. The result is that our courses are jam-packed with "must cover" topics. It is important, therefore, that faculty find ways to optimize the use of valuable in-class time. Exams are a necessary part of the evaluation in most courses and can also be an excellent learning tool, but in order for students to learn from these exams the students need to review their work and compare it to the solution. Thus, it is generally considered to be a best practice to go over exams with the students. The problem is that this can take an additional class day! And many students view the day after an exam as a free day, so attendance is low. The students that most needed the review are frequently the ones missing it. Giving four exams in a course and taking an additional day to go over these exams means approximately 1/6 of class time has been given up to exams and this does not include time to review before the exam.

Another problem with exams is the time spent after the exam is returned responding to student questions and debates on why their mistake was not all that serious. In the author's experience, the number of students who stop by during office hours is roughly the same whether the exam solution was reviewed in class or only a paper (or equivalent electronic) solution was distributed. The nature of the questions changes based on the exam solution delivery. When only a written solution is distributed, the questions tend to be based on their need to explain what their though process was and wanting to know why that was wrong. When class time is used to go over the exam, the visits tend to be an argument that their work was not all that wrong and more credit should be granted.

The question became one of finding a way to use technology to minimize the time both in and out of class going over exams in such a way that students would actually learn from the experience.

The Plan

I had moved to posting a solution to the exam on the university learning management system (LMS) and then taking 20 minutes or so in class to discuss major misconceptions or common errors. I was still getting a lot of students that came to see me after class to go over their solution one-on-one. This was an improvement over taking an entire lecture day and satisfied my need to treat this as a learning opportunity. However, there were still issues with the students that would most benefit from this discussion being absent.

At the same time, I had gone to more of my classes being flipped or blended. Students were watching videos outside of class in order to spend time in class doing more valuable activities. The view rate was good and students seemed to like being able to watch the lectures on their own schedule and at their own pace. Many commented that they appreciated being able to re-watch the videos when they were working on homework or reviewing for exams. Could this be leveraged to solve my problem with exam solution review?

This past year I began using videos of exam solutions as a supplement to the written solution. The best part was that I created the written solution simultaneously with making the video, so this required only a few more minutes of my time than what I was already doing. Each video covered only one test problem, so they were short for the students to view which increased the likelihood that they would use them. I sent out an email after the first exam explaining that they should go over the written solution which was posted to the LMS. If they were not confident that they understood the solution to a particular problem, they should watch the video for that problem. If they still had questions, they could set an appointment to talk to me about the exam. When students did set an appointment, I started by asking whether they had watched the video. If the answer was no, I asked them to review the video.

Let me explain a bit about my process of writing and grading exams. In general, after I write an exam, I take the exam myself to be sure that it can be worked in the allotted time with the allowed materials and to develop a preliminary solution to the exam. I frequently find that I need to edit one or more problems before printing and administering the exam. This preliminary solution is almost never ready for distribution at this time.

After the exam, I begin the grading process by giving a quick read to all students work on a particular problem and putting them into piles that reflect common errors and then I begin grading. As I mark their papers, I also make notes of how many points I took off or credited for various aspects of the solution. I further jot down notes of what were common misconceptions so that I can try to correct those this semester as well as in future semesters. I write up the solution and create the video after I have completed grading. This allows me to include comments based on their performance. I write up the solution and narrate my thought process. I include comments about alternatives that many had considered and incorrectly used and I can explain why that technique was not quite right. I let the computer begin compiling the video as I move on to grading the next question.

Figure 1. Recording a typical exam review video

Technology

For written exams I use an Apple iPad with an Apple pencil and Explain Everything software (https://explaineverything.com/education/). Using this combination, I can import a PDF of the exam into Explain Everything and record a voice over as a write on the exam "paper". If I make a mistake, I can rewind on the spot and replace both the written work and the recorded voice-over. I do not otherwise edit these videos. At any time, I can upload a video of any or all pages of the exam to YouTube or the LMS. I can also send a PDF of the written page to my cloud drive for posting to the LMS.
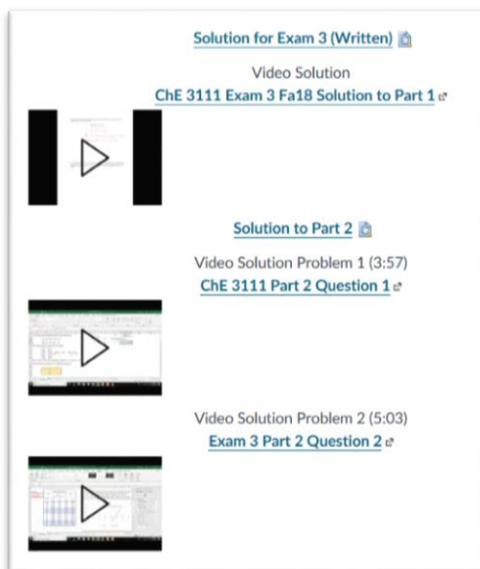

Figure 2. Sample page from LMS with written, computer, and video solutions

Some of the exams that I give are on the computer. The students submit computer files with their work. My solution, therefore, should also be done on the computer. For these, I use TechSmith Camtasia's screen recorder (https://www.techsmith.com/education.html). Again, I am able to narrate as I work. I have found that the laptop microphone is very low quality, so I use a Blue Design Yeti microphone for improved sound quality. The editor for Camtasia is easy to use, but I rarely edit these videos. Time is required for compiling the videos, but I can go ahead with other activities while that is done. Again, they are uploaded to YouTube or the LMS and the computer file is posted on the LMS.

Impact

Because I record these videos just after grading the exam, my comments are fresh and relevant. They allow me to describe the decision making process as I select which equation to use, which values to use for variables, which simplifications to make, etc. Some of the decisions that students made were unexpected, so I could not have addressed those in a video created in advance. Creating a solution in this way takes a bit more time (approximately 30% more) than just writing out the solution neatly. Saving the video and uploading it to my YouTube channel takes several minutes of computer time, but only a few clicks on my part. I estimate that adding these videos takes about 30 minutes more per exam of my time than I would have previously needed.

The students appear to be using these videos appropriately. The exam shown in Figure 2 had one portion that was theoretical derivations and written problems. The student grades on this part were low, primarily D/F average (see Figure 3). In a class of 62 students, 35 watched the video. However, on the two practical computer problems the students did much better. More than half of the students had grades of A/B on those questions. The number of views was much lower and varied relative to the average score (see Figure 3).

One reason that the students watch these is that I ask them to watch them before setting up an appointment to discuss the exam. Most students find that they can cancel their appointment with me at this point. The time savings varies based on the size of the class, but I estimate that, for each exam, I save two to three hours in office visits to go over their work. I estimate that I save ½ a lecture period with this approach and save 1.5 – 2.5 hours outside of class for each exam. For multiple courses and several exams in each class, this is a significant amount of time.
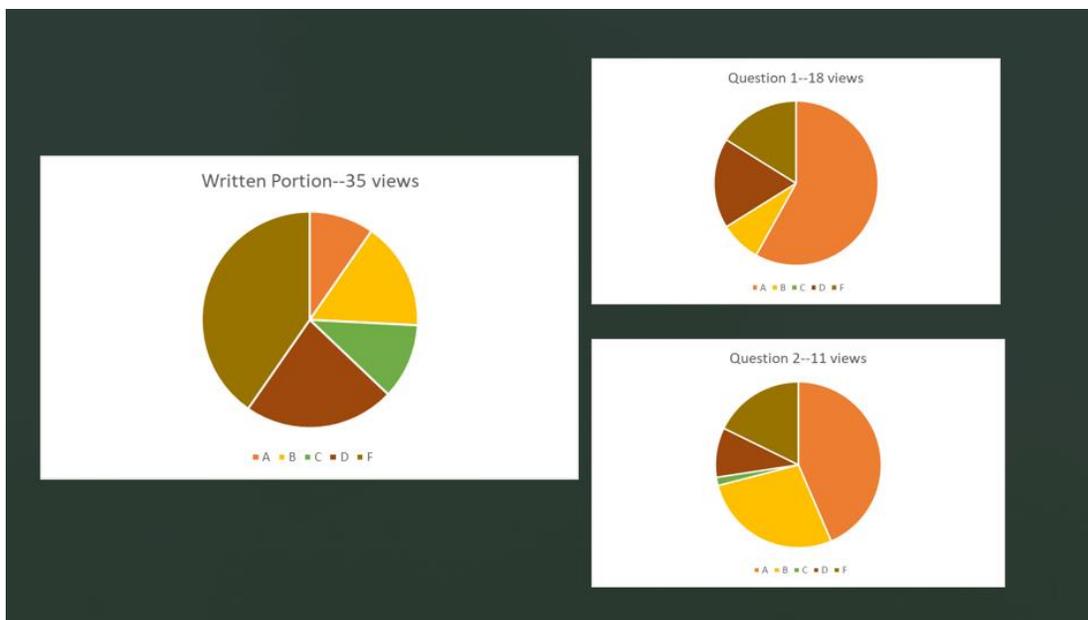
Figure 3. Student grade distribution on pieces of an exam with number of video views

I have also been told by students that they used these videos as a way of reviewing for the course comprehensive final exam. They appreciate hearing my thoughts as I discuss the solution as an efficient way to review how to solve those problems and what the decision-making process involved.

Conclusion

This simple technique has been useful for making the best use of time for me and my students while still encouraging the students to review their work and learn from their mistakes. Although not every student watches these videos, the students that need to watch them appear to be using them.

Biographical Information

Dr. Christi Patton Luks received a B.S. in Chemical Engineering from Texas A&M University, an M.S. in Applied Mathematics from the University of Tulsa, and a Ph.D. in Chemical Engineering from the University of Tulsa. She has 30 years of experience teaching mathematics and engineering at the college level. She is an active member of ASEE and currently serves on their Board of Directors as chair of the Professional Interest Council 1.