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Strengthening Communication Skills through Cadet Created Homework Videos

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Abstract

The wide availability of online tutorial videos has revolutionized the way students learn mathematics. In this project we take the approach of having students create their own homework videos by using the screen-capture and video recording capabilities of an iPad. The aims of these videos were twofold. First, through the creation of homework videos cadets conveyed technical information; this helped strengthen their communication skills. A second objective of this project was the development of an online library of videos that cadets could study from in preparation for homework and exams. In this paper we examine data gathered during this project to determine the benefits of replacing traditional handwritten homework assignments with videos. In addition, we provide some observations as to the usefulness of the videos in strengthening communication skills as well as what effects an online library of videos has on the study habits of students.

Keywords: iPad, homework videos

Introduction

Strengthening a cadet's communication skills is an integral part of developing leaders of character for the United States Military. This is of particular importance to the Department of Mathematical Sciences at the United States Military Academy, whose Academic Program includes the following communication goal [3]:

Throughout the four-semester core mathematics curriculum, cadets are expected to communicate their problem solving process both orally and in writing. They are introduced to the technical writing process and are evaluated according to the substance, organization, style, and correctness of their report.

The aim of this goal is to require students to demonstrate the ability to effectively communicate mathematics. In order to achieve this goal, the department has set forth the following objectives:

- O1** Write to strengthen their understanding of mathematics and integrate their ideas.
- O2** Discuss orally, their knowledge of mathematics to strengthen their understanding and integrate their ideas.

O3 : Understand and interpret written material (e.g, the textbook).

O4 : Listen actively to the instructor and student presentations.

Strengthening a student's communication skills requires an instructor to give ample opportunities for students to speak and communicate technical knowledge to their peers as well as their leaders. Our approach to addressing this objective was to use the screen-capture and video recording capabilities of an iPad to develop cadet created homework videos. Through the creation of these videos cadets had to orally communicate very technical information, and thus strengthen their communications skills. In addition, the availability of these videos provided an online library of videos from which all cadets could study from in preparation for homework and exams.

Background

Using screen-capture technology to create educational videos is nothing new, particularly in mathematics. In fact, a quick internet search for "math videos" leads to many websites, such as Khan Academy [9], where numerous math videos are available. These videos usually explain some mathematical concept, mostly basic algebra rules, and provide a variety of examples from which students can learn and practice.

These online video libraries are a valuable teaching supplement[11], and can impact the way students study and learn new mathematics. This is evident from the high number of views each video receives. However, the quality of each video depends on the background of the person who created it. Videos with high educational quality are often made by university faculty. The United States Air Force Academy created extra instruction (EI) videos for their mathematics, chemistry, physics, and engineering courses. These videos were viewed over 14,000 times in the fall of 2010 and are believed to have influenced the "... significant increase in the first attempt success rate on the Algebra Fundamental Skills Exam in Calculus 1" [4].

A variety of platforms exists that enable the creation of educational videos. One such tool is the iPad. In the past few years the United States Military Academy has been interested in the use of the iPad's technology to enhance teaching and learning. This interest led to the development of the iPad Pilot Study whose purposes are to [2]:

1. Identify the benefits of utilizing the iPad as a device to:
 - i improve student learning and
 - ii assist an instructor in classroom management, planning, useful applications, and/or communications.
2. Identify specific applications and uses of the iPad for meeting educational goals.

Through this iPad study, many instructors have requested iPads for use in their respective courses. At a minimum, instructors have used the iPad to provide students with an electronic course text, an e-notebook, and the ability to exchange information with their peers and instructor, see [12],[5]. The use of such devices as e-readers can be an “effective alternative to traditional books and hard copy articles,” [10].

Other instructors have developed Additional Instruction (AI) videos, see [7],[8]. These videos are a supplemental resource used to reinforce concepts taught, as well as a way to get students actively involved in problem solving. The benefits of using such on-demand resources can be great, since they “potentially help all students” [1].

Inspired by the success of online instructional videos, we decided to utilize the iPad’s technology to have the cadets create their own homework videos. This served three purposes. First, the students learned to use new technology (the iPad’s screen-capture feature). Second, through the development of homework videos cadets conveyed technical information, thus, strengthening their oral communication skills. Third, these videos were uploaded to the course website where we developed an online library of homework videos, which all cadets could access.

Method

One of the benefits of using an iPad to create videos stems from the availability of numerous educational iPad applications (apps). In this project, cadets used the Educreations app [6] to develop their videos. This free app is user friendly and allowed the cadets to create an account on the Educreations website where they could upload their videos to the internet.

The project began after the first WPR in the term. This provided the necessary time to find cadets who would be interested in creating homework videos instead of turning in a traditional handwritten assignment. Although it would be ideal to have every cadet create homework videos for every assignment, the time requirement would be insurmountable. During the time of this project I taught 49 cadets, split into 3 sections. An average weekly homework assignment would require a cadet to solve and turn in approximately 12 problems. If a video lasted 5 minutes per problem, this would require 49 hours per week to watch the videos. This does not include the amount of time required to grade and provide feedback on the assignment.

Instead of assigning all cadets to make homework videos, I chose two cadets per section who would create the videos for certain exercises. I decided to assign two cadets per exercise because if one cadet’s video was unsuitable for uploading, we had a backup video of the same exercise.

Assigning cadets a small amount of homework videos was also particularly helpful because one drawback of this app is the inability to rewind a video in order to re-record a section. If a cadet made an error a few minutes into the video, then they would have to recreate the video from the beginning. This

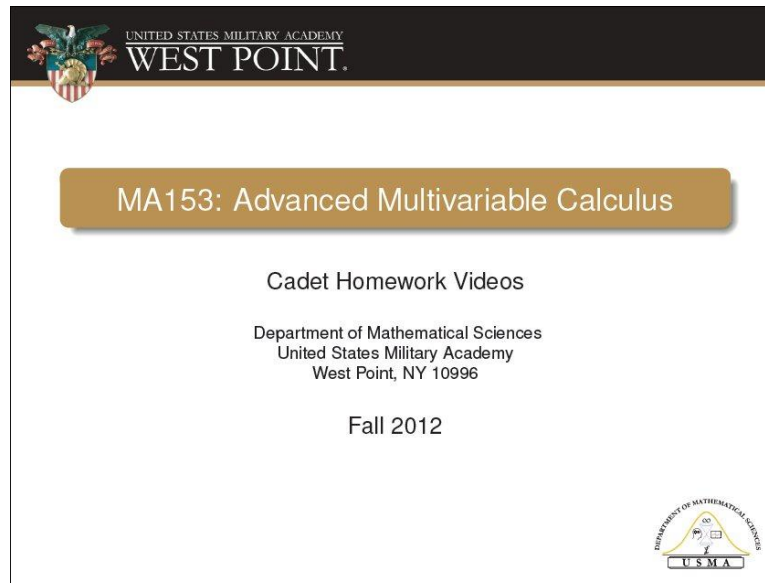


Figure 1: Initial slide for homework videos

seldom occurred, but in such cases having a second video from a different cadet helped tremendously.

Once cadets were assigned their homework videos, they were asked to make one separate video for each assigned exercise. Cadets were provided a cover sheet, see Figure 1, which they included as an initial visual aid for their videos. Cadets were asked to write out the problem they were solving, making sure to write chapter, section, and problem number. As they created the video cadets were told to work through and explain their solutions to the assigned problem. They were encouraged to have the solution with steps written on a separate sheet of paper so that they could refer to this as they worked it out on video.

The following suggestions were also provided:

1. Make the videos somewhere quiet. The library may be a good place.
2. You should read out loud the problem you are working on, even if you typed or wrote it out ahead of time.
3. List any formulas you will use.
4. Talk through the way you are working out the exercise.
5. You may want to watch a video on www.khanacademy.com. This will give you some examples of how to make the video.

Once all videos were completed, they were initially uploaded to the Educations website, then they were uploaded directly onto the course website. These videos were readily available to all cadets for studying and reviewing concepts.

With the videos completed, the project attempted to answer the following questions:

1. Does the use of cadet created homework videos affect cadets' studying patterns?
2. Did the use of cadet created homework videos help students learn new material?
3. Did the use of an iPad to create homework videos increase student engagement?

The data collected to determine the benefits of this project were obtained from the number of views each video received, as well as, from two surveys. The results are discussed in the following section.

Results

Part of the data we compiled in order to assess the project's outcomes came from an anonymous survey collected at the end of the term. Figure 2 provides a copy of the survey. The questions were written in order to measure the percentage of cadets who:

1. Knew of the homework videos.
2. Watched the videos.
3. Would recommend these videos to someone taking MA153 the following academic year.
4. Learned something new from watching the videos.

Figure 3a shows that 93% of cadets knew about the videos, while Figure 3b shows that of those that knew of the videos, about a third (32%) actually watched them.

Cadets provided the following reasons for not watching the cadet created homework videos:

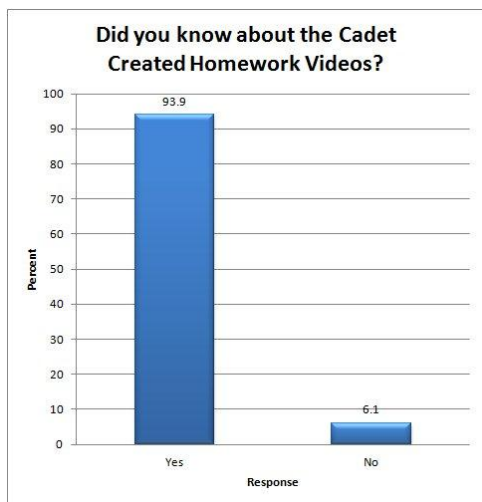
- "I don't really have an issue understanding the concepts taught in the class."
- "I felt pretty confident about this particular chapter, so I studied the way I usually do. But I will definitely review them before the TEE."
- "I never got around to it"
- "I felt that I had a good grasp on the concepts when I completed the homework, and did not need to look at the homework videos. However, I think it is a really good idea to have them because if I had a question on the homework, it would be worked out by one of my peers and explained in a way I could understand."

Homework Videos - Questionnaire

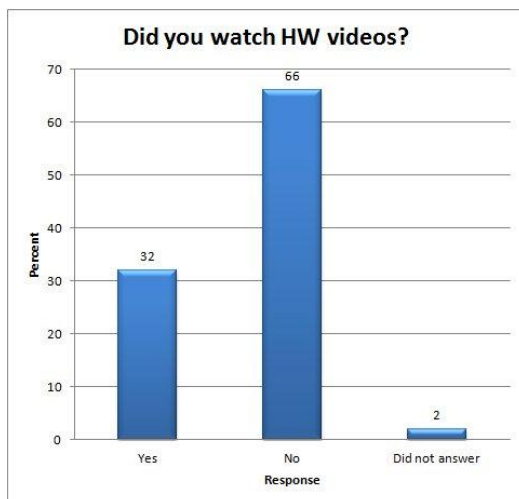
1. Did you know about the cadet created homework videos?
YES (Continue to question 2) NO (You may stop survey here)
2. Did you watch any of the homework videos?
YES (Skip to question 4) NO (Continue to question 3)
3. Why did you not watch any of the videos? (You can turn in your survey once you have answered this question.)
4. How many videos (approximately) did you watch? _____
5. On a scale from 1-10 how helpful were the videos?
Not at all helpful Somewhat helpful Helpful Very Helpful
1 2 3 4 5 6 7 8 9 10
6. Would you recommend these videos to someone taking MA153 next year?
YES NO
7. What was your main reason for watching the videos? (Circle all that apply)
a) Study for homework
b) Study for WPR
c) Study for TEE
d) Recap material covered
e) Other: _____
8. Did the availability of these homework videos affect your study patterns?
YES NO
If so how: _____
9. Did you learn something from watching the cadet created homework videos?
YES NO
10. How could the videos be improved?

Any other comments you would like to make regarding the homework videos?

Figure 2: End of project survey



(a)



(b)

Figure 3

- “I would have watched the videos had I not understood the material. I think they were probably a very valuable resource but I never watched them because I understood the material.”
- “I never got around to it. I meant to at some point, but I never made it a priority.”
- “I meant to watch these videos but I never got around. I will probably watch some of the videos in order to prepare for the TEE.”
- “I always wanted to watch them, but I never thought of them when I went back to my room. I’ve always benefitted from watching math videos on youtube so I know these would’ve helped and I regret not watching them.”
- “I don’t learn very well that way, I just used the answer key to figure out what I needed to do and pieced together the rest.”
- “I used the solutions book to learn the homework.”

Concentrating on those cadets that watched the videos, we have the following information: Figure 4 depicts the percent of cadets who watched a certain number of videos. For example, 28.6% of cadets who watched the videos, said they watched one video.

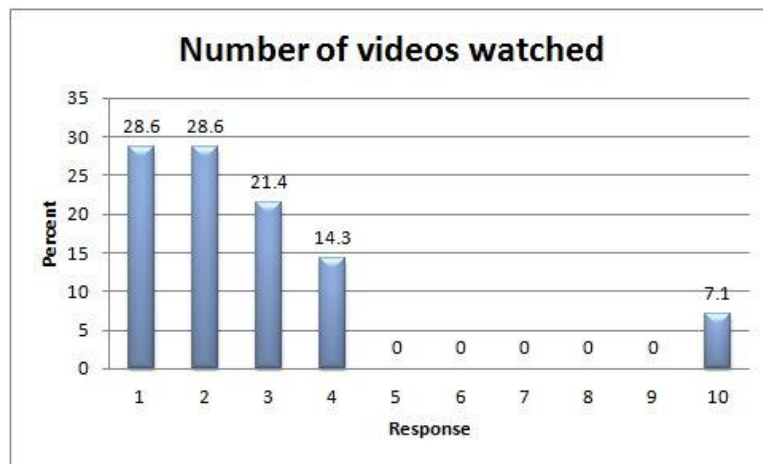


Figure 4

In addition, we wanted to measure on a scale of 1-10, 1 being "Not helpful at all" and 10 being "Very helpful", how helpful the homework videos were. The results of this questions are reflected in Figure 5.

Also knowing the main reason cadets watched the videos could help in future terms by providing feedback as to what subjects could most benefit from having homework videos made. We also aimed to discover if the availability of such videos changed the way a cadet studied for graded events and whether they

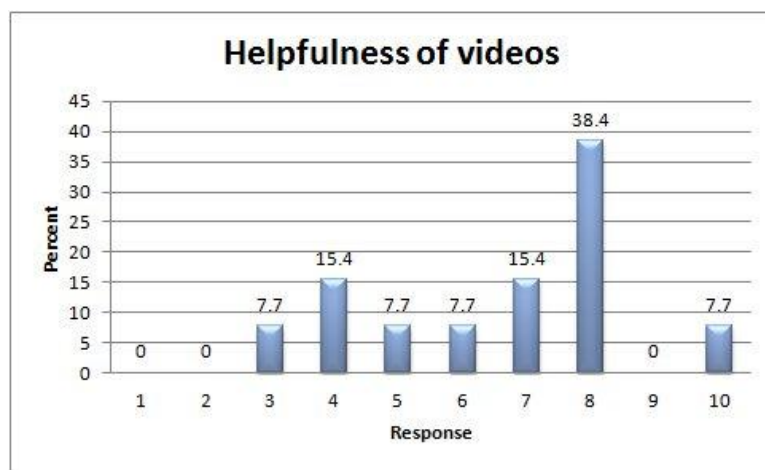


Figure 5

learned something new from watching the videos. This was the purpose of questions 7-9 in the end of project survey. Figures 6a-6c provides a visual representation of the results of that part of the survey.

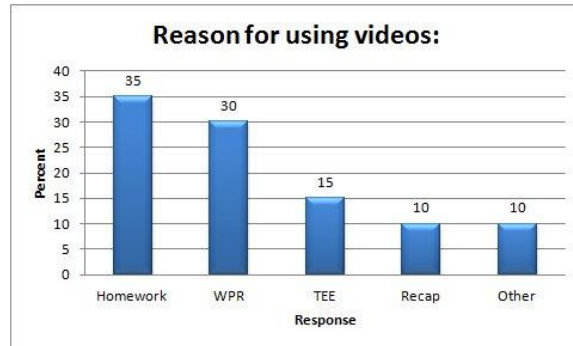
The end of the project survey, estimates that only about 40 videos were watched. However, the application Educreations allows an instructor to track the number of views a given video has received since being uploaded. Figure 7 shows a graph of the total number of views¹. Based on the information on this website and the corresponding figure, we can see that by December 18, there had been 92 total video views. This discrepancy on total number of views is quite large. We conjecture that the discrepancy stems from the fact that the videos were uploaded to the main MA153 course website. Therefore, the videos were accessible to all 301 cadets who took the course in the fall of 2012, not just the 49 cadets who completed the end of project survey.

The most striking result from the end of the project survey is that 100% of those students who watched the homework videos said they would recommend their use in future MA153 courses. This shows that the videos are a great resource for students as the study for homework and WPR's.

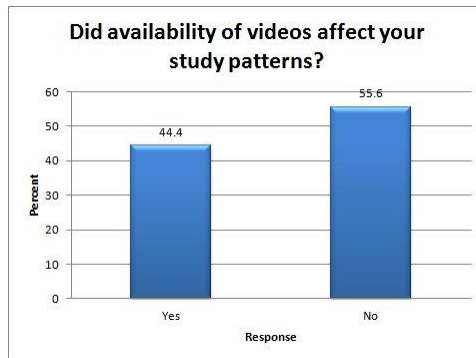
In addition to the end of project questionnaire, a reflective survey was provided to the cadets who were involved in creating the videos. See Figure 8 for sample survey. Through this survey we wanted to determine what aspects of creating these videos were the most beneficial and whether creating the videos increased a cadets engagement with the course material.

From the data of the survey, we found that 33% of the cadets who created the videos had never used an iPad prior to creating the homework videos. Using a scale from 1-10, 1 being "Extremely difficult" and 10 being "Extremely easy",

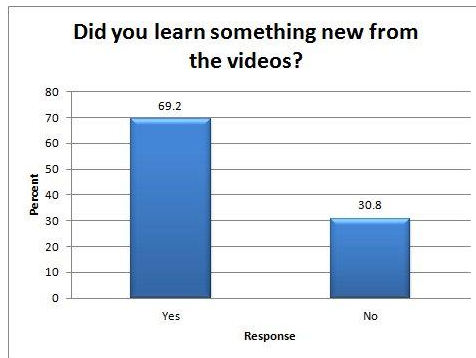
¹On Figure 7 some days are missing because of inconsistent log in to check the number of views videos received on the Educreations website.



(a)



(b)



(c)

Figure 6

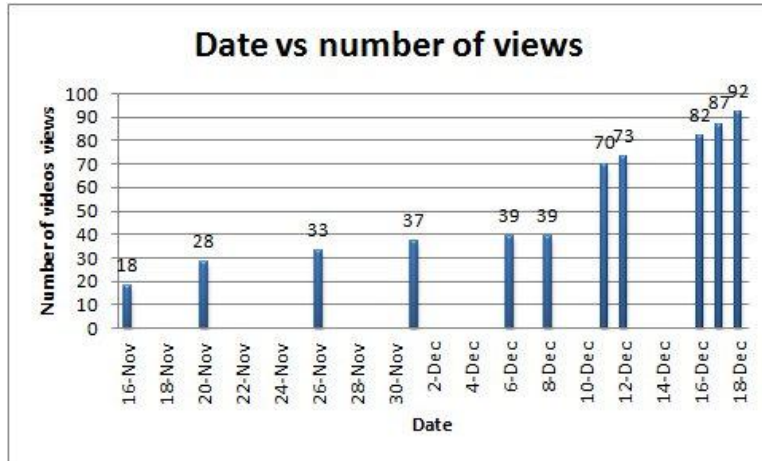


Figure 7

Cadet - Questionnaire

- Was this your first time using an iPad? Y / N
- On a scale from 1-10: How user-friendly was the iPad itself?

| | | |
|--|---------|-------------------|
| Extremely Difficult | Neutral | Extremely Easy |
| 1 2 3 4 5 6 7 8 9 10 | | |
- On a scale from 1-10: How easy was it to make the videos using the Educreations App?

| | | |
|--|---------|-------------------|
| Extremely Difficult | Neutral | Extremely Easy |
| 1 2 3 4 5 6 7 8 9 10 | | |
- What did you gain from creating homework videos that you did not get from traditional pencil/paper homework?
- Why did you agree to participate in creating these videos?
- How could the videos be improved?
- Did your use of an iPad to create homework videos increase your engagement with the course material?

Any other comments you would like to make regarding the homework videos?

Figure 8

to determine how user friendly the iPad was, the average rating was an 8, which also was the median. Using this same scale to determine how user friendly the Educreations app is, cadets had mixed reactions. The responses given were: 3, 5, 6, 7, 8, and 10.

The remaining part of the survey asked cadets to provide some feedback regarding their experiences making the homework videos. The comments to each question are recorded below.

4. What did you gain from creating homework videos that you did not get from traditional pencil/paper homework?

- “I needed to have a better understanding of the material in order to explain it. I felt the need to provide a “why” in addition to a “how.” ”
- “It forced me to redo homework problems, thoroughly comprehend what the questions were asking, and learn how to talk intelligently about math. Since it was also very time consuming, I became a better person by learning to be more patient with myself and take responsibility for an assignment I volunteered for. ”
- “I was able to better review each problem by re-doing it when I am more knowledgeable of and acquainted with the problem, significantly solidifying my knowledge of the material and boosting confidence.”
- “Creating the videos with the intent of showing them to someone else gave me a better understanding of the material.”
- “I had to explain to myself exactly what I was doing, so it helped me with trying to understand the problems and learn what I was actually doing.”
- “I was able to help other students so that they would understand why different steps were taken rather than just showing my work.”

5. Why did you agree to participate in creating these videos?

- “It seemed like a more interesting way to complete my homework.”
- “I knew that doing this would help/force me to really understand the lessons.”
- “I felt my experience with iPads and interest in technology would benefit the math department’s trial run of iPads.”
- “I thought it would be a good way to help my classmates and the department, seemed like a fun thing to do.”
- “I thought it would be a good learning experience and it would also be helpful to others since I too had watched similar videos which have helped me in the past.”

6. How could the videos be improved?

-
- “More needs to be done to make the videos entertaining and captivating. I found myself often stretching to achieve this.”
 - “Have us use a different video creating app where we will be able to pause and save in the middle of lessons and manipulate the video so we can delete portions of the video where we messed up so we don’t have to start all over.”
 - “Videos could be improved by reducing the amount of videos video-makers must make in order to allow them to dedicate more time to each video and present them with more quality penmanship/explanations.”
 - “For me, everything went pretty well. My suggestion would be to pair cadets up and have them make videos together. It might make things easier on them, or be a better learning experience for the video-makers.”
 - “Allowing us to edit videos would be nice so we can refine them and not have to restart if we say something incorrect.”
 - “I thought it would be fun and allow me to indirectly help more students understand the concepts in this chapter.”
 - “Although I know there is not a better program at the moment, a program that is more open to editing so we can go back and change something rather than having to start over and do everything again.”
7. Did your use of an iPad to create homework videos increase your engagement with the course material?
- “I felt that making the videos forced me to have a greater understanding of why the problem is solved in a particular manner. ”
 - “Most definitely.”
 - “Absolutely. I often had to re-learn some missed material in the process of making videos.”
 - “Yes. I wanted to make sure I fully understood what I was doing before explaining it to someone else. I was learning by teaching.”
 - “Yes, I had to focus on reasons why I did things instead of just going through the motions. It engaged me with the problems and I learned how much I knew and how I could explain what I was doing.”
 - “Making the videos helped me fully engage myself into the course material because I had to make sure I understood the smallest details of the material so I could correctly make the videos to help other students and avoid further confusion.”
8. Any other comments you would like to make regarding the homework videos?
- “It’s really difficult to write legibly on the iPad. The stylus improved this, but not perfected. The app was a bit cumbersome for recording the videos. I’m not sure that can be improved.”

- “Those who volunteered to make videos should be rewarded with Pringles now that we have a greater appreciation for saddle points.”
- “They are a great, resourceful idea - certainly promising for future homework at the academy. If possible though, iPad homework should be distributed to other students so a small minority does not have to make upwards of 7 videos per block in addition to traditional homework.”
- “Although the videos are great as a teaching tool, iPads cannot replace the convenience of turning in paper homework. The technology is not always reliable, especially with the lack of good WiFi here, and they are clumsy to write on.”
- “I thoroughly enjoyed making the videos. I wish we had started earlier so we could get more practice making them so they came out better by the end and so we could cover more topics. I would love to continue doing this in the future if the opportunity comes up again.”

Summary

By having cadets create homework videos in lieu of a traditional handwritten homework assignment, cadets had to engage in the course material. They needed to show technical knowledge and provide details of the material they were presenting. This forced them to truly understand what they were teaching. As one cadet put it “I was learning by teaching.”

By having many homework videos we were able to create an online library of videos that were available to all cadets taking MA153. These videos were a great resource for students, especially as they studied for graded events. By creating our own library we were able to have a quick reference of problems and a video which showed a step by step solution or technique. The fact that 100% of cadets who watched the videos would recommend their use in future terms tells us that this resource can play a huge role in the way our cadets study for their courses.

One recommendation is to encourage students to be creative when making their homework videos. One cadet really embraced the idea of creating homework videos with high production value. This particular cadet began and completed his videos with music, and through his videos, he showed great technical understanding of the material he presented, and more importantly he had a great sense of humor. His videos were not only precise, but were entertaining. By encouraging a student to be creative, they can grow in confidence, as well as, mathematical skill.

Given the opportunity to implement this project again, I would have all students in the course participate in the video creation, as opposed to only a few cadets per section. This would get everyone involved and would help all cadets feel connected to the course material, since they are creating their own

homework videos. I would also start this project as soon as the course begins would provide videos for all topics covered in the course.

Overall this project provided a new way to get students to actively participate in their own learning. Cadets created videos that strengthened their communication skills. Through the development of these videos, we were able to create an online library of videos which became a great resource for cadets as they prepared for homework and exams. As one cadet said “[The videos] are a great, resourceful idea - certainly promising for future homework at the academy.”

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