AC 2011-753: WORK IT BABY, WORK IT! REWORKING THE WORKSHEET IN CAMTASIA

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Work It Baby, Work It! Reworking the Worksheet in Camtasia

Abstract

Faculty teaching Engineering Mechanics at Florida Gulf Coast University (FGCU) continuously seek means to improve student learning and respond to student feedback in this integrated lecture-lab course. Worksheets are available through the online Course Management System (CMS) for students to print, and each lesson has a worksheet with typically two or three problems to solve during class. The instructors encourage students to work at white boards that surround the perimeter of the room (which includes rolling white boards to accommodate all students). Board work not only allows the instructors to see the work as they walk around the room to assist each group, it also encourages students to discuss each step of the problem solving process with their peers encouraging some to become the "teachers" for the problem. A common student critique of this course is the lack of time to copy work from their board work into their notes. The challenge for the faculty is balancing between those students that finish quickly and have time to copy board work onto their worksheets and those that are still working at the board when the class comes back together at their tables. Though the worksheet solution is briefly discussed, it is often the students that need the solution in their notes that do not have time to completely record the material from their board work as the instructors continue with new course material. Additionally, student solutions for these problems, though correct, may take a more indirect path to solving the problem, as board work is often the first attempt at approaching a new topic.

The instructors used Camtasia Studio (with voice-over recordings) to provide step-by-step solutions to many of the dynamics worksheets that the students solved in groups at the whiteboard. These solutions were posted to the CMS for students to reference on their own. The authors assessed how students scored on exams 4 & 5 (dynamics exams) and compared their performance to exam 3 (statics final). Additionally, the authors noted who accessed or did not access the recordings and compared changes in grades. Assessment of students' perceived gains in topic comprehension was documented from the end of semester survey. These demonstration worksheets reinforced new material, providing students the opportunity to learn, to an extent, at their own pace and transform the course into an effective "hybrid" learning environment.

Background

Engineering Mechanics at FGCU is a four credit hour, five contact hour course, in which both statics and dynamics' topics are covered, with emphasis on statics. The increased contact hours provide the instructors and students two and a half hours of class time twice a week, during which the students have ample opportunity to actively learn the new topic by solving problems in teams at the board. After a topic is introduced and a short problem solved as a class at the board with the instructor, students break into small groups at the instructor's call to arms, "To The Boards!" It has been well documented through course assessment surveys that students appreciate and value the time they have to work problems during class, to discuss solutions with their classmates, and to ask questions of the professors.[1] A common critique from these assessments is the lack of time students have to copy their work from the board into their notes. While some groups finish early and have ample time to copy their solution, many do not finish the problem before the instructor briefly reviews the solution and proceeds to the next topic or problem. These are the students that do not have the time to copy their work, and likely are the ones that need more time to fully understand the steps for solving the problem. Some students revert to working at their desks and solving the problems on their own paper, which limits many of the team aspects that the instructors encourage at the board, like discussing questions with their team members. Anecdotally, it is the stronger students that will inevitably sit down at their desk, which again disrupts the constructs of collaborative learning especially for the weaker students. Historically, the instructors adopted the policy of not posting worksheet solutions to the CMS, since they feel some students might coast during class knowing the solution is available to them after class.

This semester, the instructors provided videos of at least one problem in each worksheet set for the dynamics portion of the course. These videos, created in Camtasia Studio by TechSmith (Okemos, MI) , provided a step-by-step solution of the problem with the instructor explaining and emphasizing key points. Attempts were made to limit the videos to approximately five minutes each, since long videos could have been a deterrent to watching. Two steps were taken in creating the videos. First, the instructor recorded the screen shot of the solution while discussing the keys elements of the solution process. Once the video was saved, Camtasia

Studio allows the user to zoom in on specific areas or highlight details. Figures 1 and 2 demonstrate a general video screen and how effects were used to highlight steps in the problem, respectively.

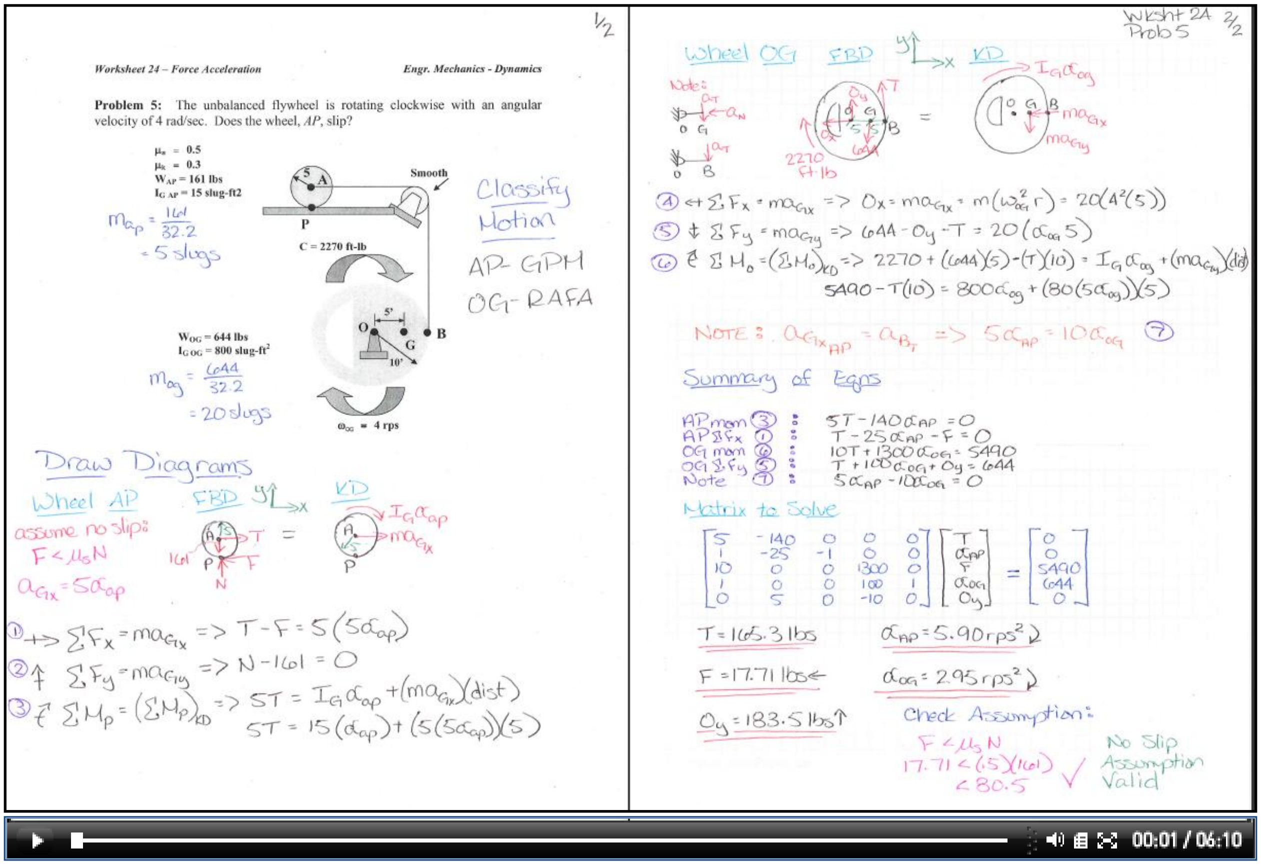

Figure 1: Starting screen of video for force acceleration problem

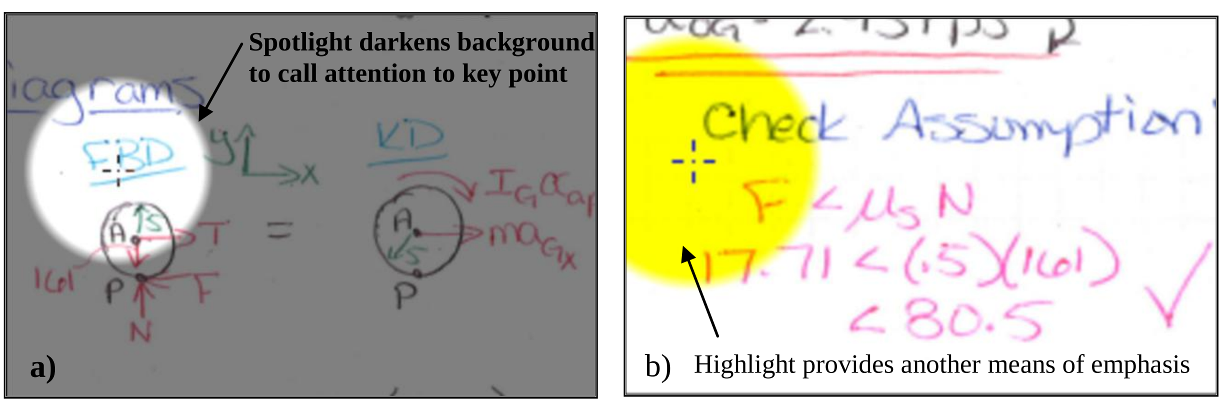

Figure 2: Zoomed screen shots during video using a) spotlighting and b) highlighting to emphasize important points of the solution process

One of the advantages of the video, and particularly spotlighting or highlighting, is the emphasis it allows the instructors to place on specific aspects of the problem. For example, in Figure 2a, the instructors chose to spotlight the step of creating a free body diagram and setting this equal to a kinetic diagram for the purpose of developing the force acceleration equations. This step is critical for student success, and the spotlight allows the instructor to reinforce the concept. In Figure 2b, the yellow highlight stresses the importance of checking assumptions made at the beginning of the problem, as the correct solution is limited based on whether or not this assumption is correct. This is a step often missed by students, so the specific highlight at the end of the video is again additional reinforcement of critical problem solving steps. The use of these videos is somewhat similar to the approach of lecture capture for a course, which is becoming a more widely utilized option in higher education[2] and trends in the direction of a blended learning classroom.[3]

Once the instructors were familiar with the software, the entire process of making the video took 20 – 30 minutes for each solution, which becomes a permanent archive for future courses. While this was the first attempt to create the videos, with limited editing or polishing, the students responded favorably to the additional instruction on the dynamics problems. The following assessment includes video access and effect on student scores along with responses to several questions posted on an end-of-the-year survey.

Assessment

Both a quantitative and qualitative assessment of the videos was performed using data from the CMS site and from the student surveys delivered at the end of dynamics. There were two sections of Engineering Mechanics taught in the Fall 2010 session, with an enrollment of 29 students in section 1 and 32 in section 2. Both classes had relatively the same percentage of students who viewed at least one of the five videos, 76% and 75%, respectively. Also, 30 – 40% of each class viewed either four or all five of the videos offered in the course. Figure 3 summarizes the percentage of students that viewed a given number of different videos. It does not consider the number of times students viewed each video.

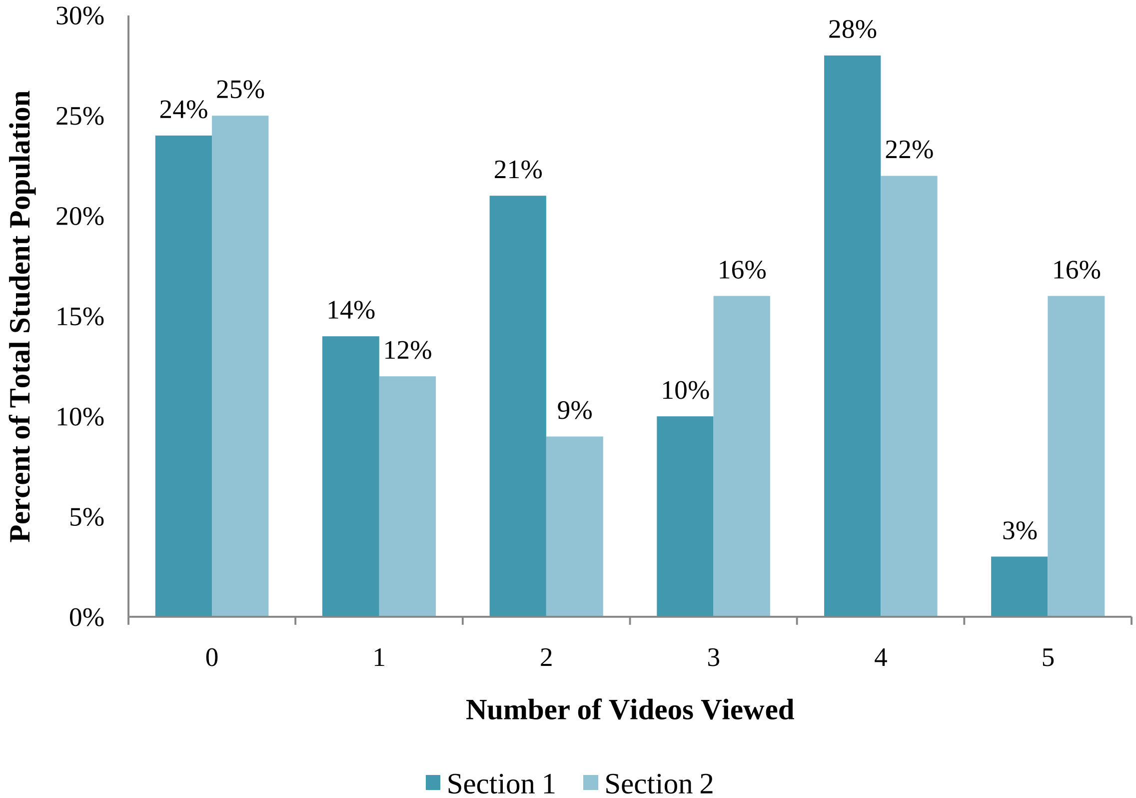

Figure 3: This graph details the percentage of students in each section that viewed the videos.

Figure 4 details the number of times individual students from both sections viewed a video. On average almost half of each class, 43% and 51% respectively, viewed each video when it was uploaded to the course management site (data not presented). As illustrated in Figure 5, the majority of students viewing (63%) accessed videos only once, while approximately a quarter of those viewing (23%) viewed twice and the remaining 14% accessed three of more times. These values indicate the number of times a student "accessed" the particular video. It is possible that the students viewed the video multiple times in a single access, as well as viewing only a select portion of the video. Additionally, since the students often study together in groups, it is possible that multiple students viewed a video in a single access, not simply the individual who retrieved the video.

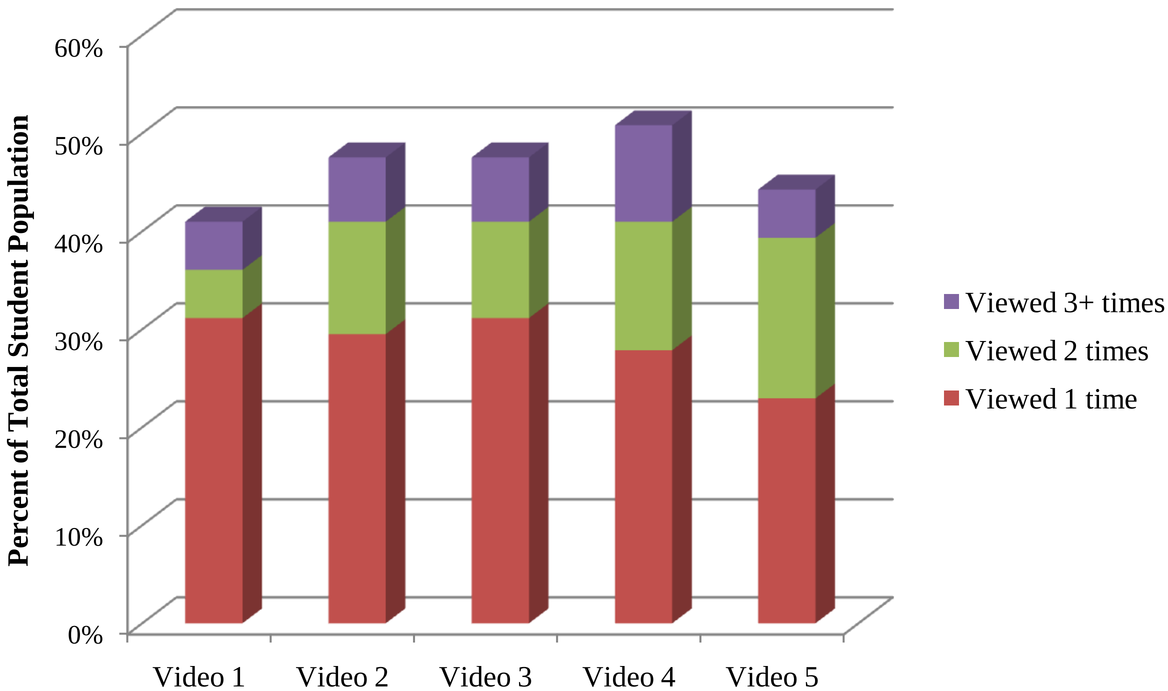

Figure 4: Distribution of students by number of times viewing video. The graph details the combined data from both sections. Video 1: Instantaneous Center of Zero Velocity, Video 2: Kinematics (General Plane Motion), Video 3: Force-Acceleration, Video 4: Work, Video 5: Energy.

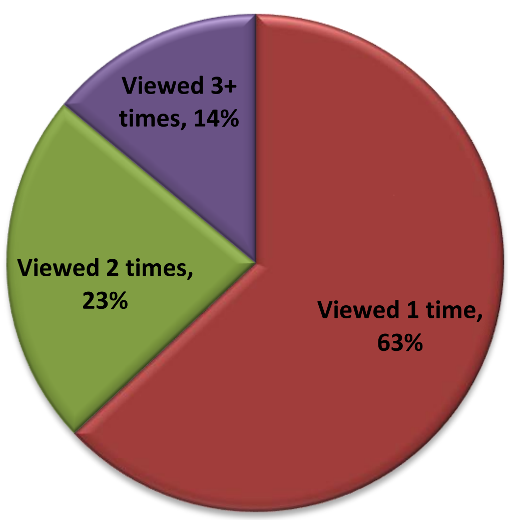

Figure 5: Percent distribution of students based on number of times viewing videos. The chart considers only those students viewing videos, and is based on times accessed only.

Finally, the instructors assessed how the students performed on exams 4 and 5, for which the videos were offered, and exam 3, an equally challenging exam, for which the videos were not offered. Figure 6 presents the percent change in exams grades for both sections 1 (darker bars) and 2 (lighter bars) for students that utilized at least one video versus students that did not view any videos. Solid bars indicate the average improvement or reduction, while error bars show the minimum and maximum values for individual students. No error bar is presented for section 2 positive data as only a single student, who did not access a video, posted a positive improvement on exams.

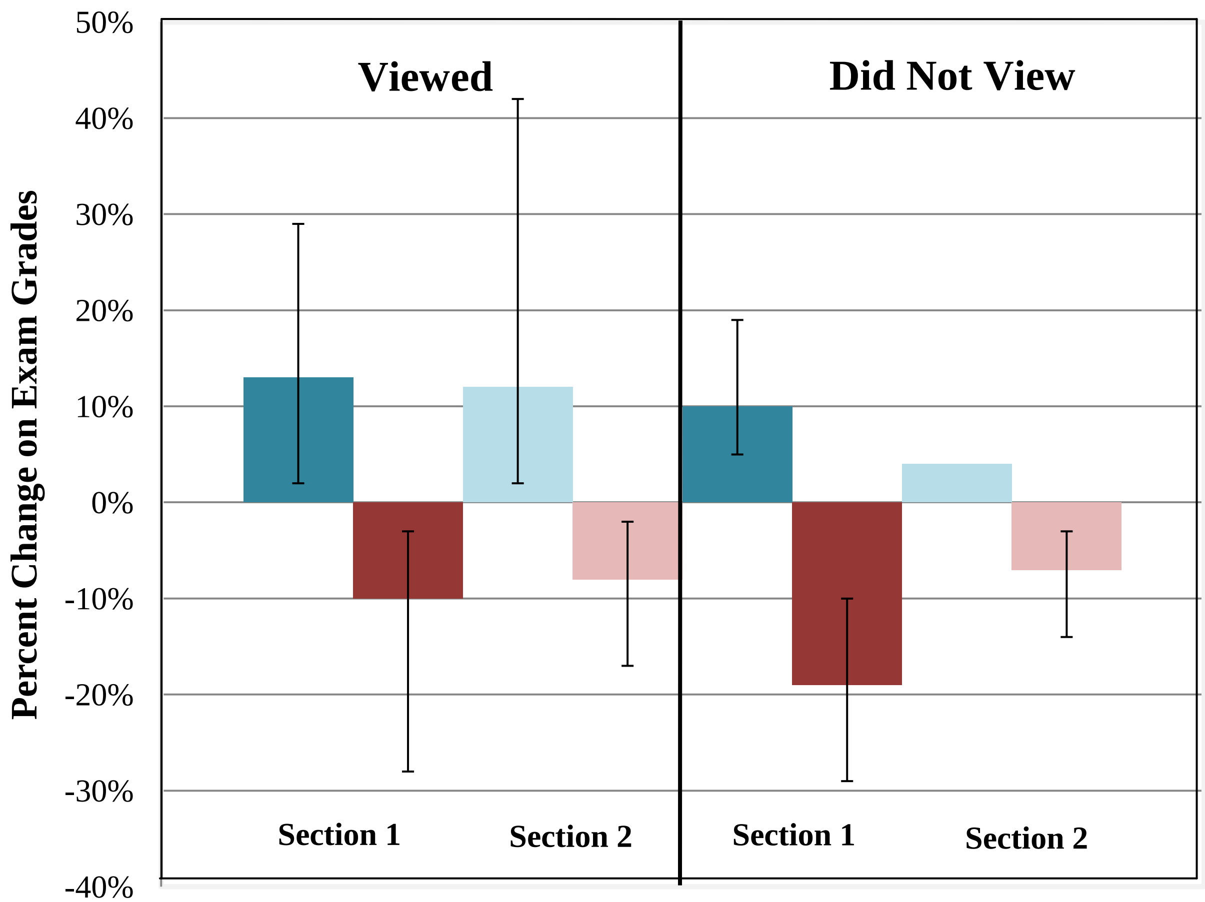

Figure 6: Percent change on exam grades from exam 3 to exams 4 & 5 for students in both sections comparing those that viewed at least one video versus those not accessing the videos.

For section 1, 22 students utilized the videos; of those 22, 13 saw an average of 13% improvement in their exam 4 & 5 scores, while nine students scored an average of 10% lower.

For the section 2, 23 viewed the videos; 13 improved their average score by 12%, while eight students scored an average of 8% lower. (Two students saw no change in exam scores). When considering students who did not utilize the videos, seven in section 1 fell into this category; of these seven students, three saw an average improvement of 10% in their exam scores, while the remaining four had an average of a 19% reduction in exam scores. For section 2, eight did not view the videos; of these one experienced an improvement of 4% in exam scores, while the remaining seven scored on average 7% lower.

The end-of-semester survey included four questions about the students' perceptions of the videos. Each question was scored on a Likert scale of 1-5, with 1 = Strongly Agrees and 5 = Strongly Disagrees. Combined results from both sections for these assessment questions are summarized in Table 1.

Table 1: Critique from year-end survey. Students scored the following four questions on a Likert Scale of 1-5: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree.

Course Critique	**Avg**	**Std Dev**
I believe the Camtasia videos increased my comprehension of course topics.	1.98	0.80
I would prefer printed solutions only to the voice-over recordings.	2.54	1.27
Listening to the videos helped me understand how to approach Dynamics problems.	1.94	0.80
The effectiveness of the Camtasia videos was independent of the instructor speaking.	2.49	0.88

In addition to these questions, students were asked if they accessed the videos and what they found most helpful. The following are few of the comments received from both sections of the class.

- *"Yes. Step by step on how to do some sample problems."*
- *"No, I did not use the videos solutions as of this moment. I believe that the videos would be used more if they were on problems other than the ones solved in class."*
- *"Yes, being able to do step by step solutions. Wish there were more videos."*

- *"No, just never had a chance to look at it. Will look when studying for finals."*
- *"I used them and they were helpful. Just a little hard to follow at times because of losing sight of the original problem when it was being worked out."*
- *"Yes. Good, clear explanation of problems."*
- *"Yes, allowed to see it the right way when struggling doing it on my own studying."*

Discussion

Creation of the videos is still in its infancy for this course, but from this initial assessment, the videos were a welcomed tool with 75% of the students in each class accessing the videos and with anywhere from 23% - 47% (of the students watching) viewing the videos more than once. This alone is impetus to continue making the videos and expanding their usage in the course. Though many variables influence how a student performs from one exam to the next, the initial trend in the data suggests that students using the videos improved their scores from exam 3, for which videos were not available for the material covered, to exams 4 and 5, which included the videos of various topics. The instructors compared exam scores of students utilizing the videos as a learning tool to those who did not. Of the 43 students in both sections who accessed the videos, 60% showed an increase in their exam scores for 4 & 5 over exam 3, with the average increase of 13%. Of the 15 students from both classes that did not view the videos, 11 (73%) scored lower on the exam average of 4 & 5 as compared to exam 3. Finally, from the course survey, students agreed or strongly agreed that the videos increased their comprehension of the materials and helped them understand how to solve dynamics problems. While students on average agreed (2.54) that they would prefer the printed solutions to a video (which included the students that did not view the videos), some students acknowledged the additional assistance of the voice-over recordings, which details the solution more than the printed text. While it is too early to report the true effectiveness of the videos, these early assessments are encouraging. In future courses, the instructors will continue adding videos for worksheet problems covered in exam 3 and expand the videos to include solutions for homework problems, as recommended by a few students in the course.

It is worth noting that many of the students do take pictures of the whiteboards with their phones to save their work. While this is one solution to documenting their work, it is not necessarily in the orderly format of a professor's solution. At this early stage of learning, they are still developing the process of solving engineering mechanics problems, so their work is not systematic. The videos not only show the format of the professor's solution, but also include the voice over and highlighted sections for emphasis on the most important aspects or useful hints for the solution. This inclusion helps to stress the process of the problem solving and not simply the correct answers for an individual problem.

Conclusions

The instructors created the videos for in class worksheet problems in the Dynamics section of an Engineering Mechanics course in an attempt to address a critique from previous years that there was not enough time to copy complete worksheet solutions from team board work. The five videos covered various topics and included voice over from the instructors detailing the solution. Once the instructors were comfortable with using the software, creating the videos took approximately 30 minutes to complete and averaged between 5 – 7 minutes in length. Assessment of student access and performance indicates that the students utilized the videos, appreciated the additional learning tool, and saw a trend in improved exam scores. The instructors will continue to create these videos for additional worksheet and possible homework solutions and plan to expand the assessment from both a qualitative and quantitative standpoint.

References

[1] O'Neill, Geiger, Csavina, and Orndoff, "Making Statics Dynamic! Combining Lecture and Laboratory into an Interdisciplinary, Problem-Based, Active Learning Environment," *2007 ASEE Annual Conference and Exposition*, Honolulu, Hawaii, June 2007.

[2] Zhu and Bergom, "Lecture Capture: A Guide for Effective Use," *Center for Research on Learning and Teaching*, University of Michigan, via Internet at http://www.crlt.umich.edu/publinks/CRLT_no27.pdf (January 2011).

[3] Picciano, "Blending with Purpose," *Educause Learning Initiative Meetings*, via Internet at http://www.educause.edu/Resources/BlendingwithPurpose/213770 (January 2011).