

# USE OF PRE-RECORDED VIDEO DEMONSTRATIONS IN LABORATORY COURSES

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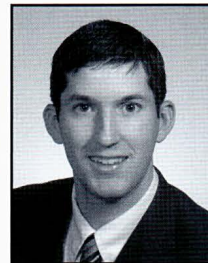
In our unit operations laboratory courses at Louisiana Tech University, students are required to write two reports for each experiment performed: a pre-lab report due prior to performing the experiment and a final report due after performing the experiment. Since the pre-lab report includes sections dealing with safety, background information, and experimental procedure, it is important that students are exposed to the equipment beforehand. As instructor of these courses, my previous approach to providing this exposure was to personally give each lab group a walk-through on their next experiment after they finished the current week's experiment. In these walk-throughs, I would point out the various valves/switches/gauges/etc. needed to manipulate and monitor the process variables.

## DRAWBACKS TO THE PREVIOUS APPROACH

There are several disadvantages associated with having an instructor give each student team a personal walk-through on their next experiment each week. The first is that it takes up valuable class time. Previously, students would have to stay in class after completing their experiment for that week in order to receive a walk-through on their next experiment. This was particularly inefficient when two or more student teams finished their experiments around the same time, because it meant that at least one team would just be waiting around for the instructor to finish giving a tutorial to another group of students before he could provide such a tutorial for

them. Secondly, this delivery approach requires the instructor to give a tutorial on every experiment each week, which becomes rather tiresome and repetitive. Additionally, the personal walk-through necessitated that students quickly jot down notes or try to remember key points as the instructor went over their next experiment with them. An obstacle to student retention of the experimental demonstration is the fact that these students will have often already been in the lab for up to three hours performing an experiment before receiving the tutorial, often leaving them fatigued, uninterested, and/or unmotivated while listening. Given studies regarding the limited attention span of students,<sup>[1-4]</sup> this seems to be a highly suboptimal learning environment. This is made worse by the noises and other distractions caused by experiments still taking place around them.

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## VIDEO APPROACH

A few summers ago I videotaped these experimental demonstrations and now I post these videos online (which is easily done through course managements systems like Blackboard or Moodle, or through YouTube or other video-sharing mechanisms) for students to view outside of class, prior to performing their next experiment. The goals of the pre-recorded tutorials are threefold: to introduce equipment and explain the objectives of each experiment, to demonstrate any special techniques that are used in performing the experiment, and to indicate the location of various valves, switches, meters, and other instrumentation used in the experiment. This is illustrated in Figure 1, which shows screenshots captured from videos used in our laboratory courses.

The idea of shifting some (or all) classroom instruction to screencasts<sup>[5,6]</sup> and other Web-based videos<sup>[7-11]</sup> is gaining popularity in engineering lecture courses (as in the “flipped” or “inverted” classroom model<sup>[12-15]</sup>), and this seems like a logical extension of that idea to laboratory courses. The videos are intended to supplement, but not replace, written instructions and guidelines for each experiment. Having additional audio and visual instruction for these experiments should benefit students of different learning styles as they prepare for their upcoming experiment,<sup>[16-18]</sup> as well as provide clarification regarding the placement of process lines and instrumentation in the experimental apparatus. The videos need not

have high-end production quality in order to achieve their basic goals,<sup>[5]</sup> but an instructor could certainly add captions, labels, and subtitles to the videos to provide further clarity. The price of video-recording devices has decreased enough over the years that even high-definition camcorders are no longer cost-prohibitive.

## BENEFITS OF THE VIDEO APPROACH

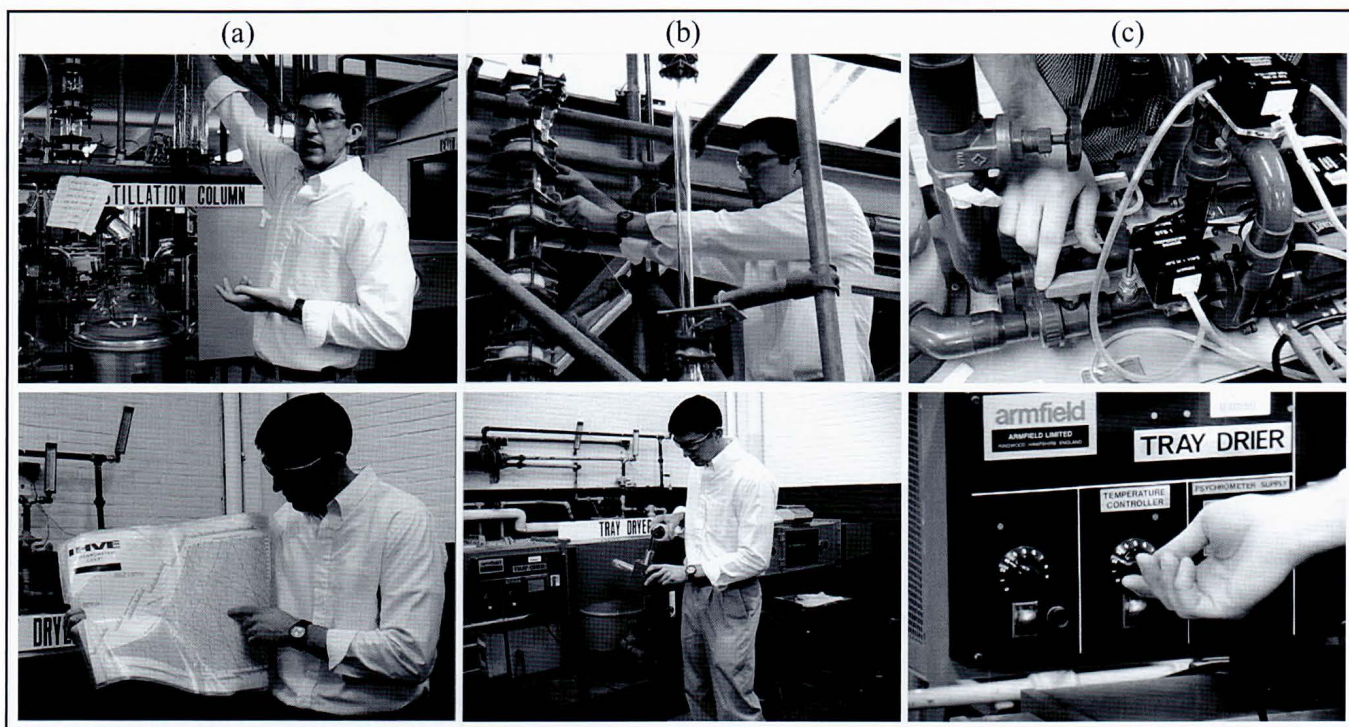
There are several benefits to the use of pre-recorded video demonstrations, especially when compared to the previous approach of personal tutorials:

### Benefits for Students

- *Less time spent in class* – Students can now leave class when finished with their assigned experiment for that week.
- *Students can watch videos in an “on-demand” setting* – Students can pause, rewind, re-watch, etc., the videos as needed while watching them at their convenience. This can be particularly helpful while they prepare their pre-lab reports.

### Benefits for Instructors

- *Less time spent in class* – The instructor can leave after the last experiment is finished, rather than waiting to give another tutorial.
- *Less repetition for instructor* – The instructor now only



**Figure 1.** Screen-captured images from the video tutorials illustrating (a) introduction and explanation of the experiment, (b) demonstration of experimental techniques, and (c) the location of valves and control knobs used in the experiment.



needs to give the tutorial for each experiment once while being filmed, and the resulting video can be used for as long as the experiment is used in the class.

- More consistency in information given to each lab group – As a result of giving so many personal tutorials, I would occasionally forget to tell a group something that I told another. With the videos, every team has access to the same information, and the videos can be edited to ensure that they are comprehensive.
- Useful training tool for new lab instructors or lab assistants – As a library of these videos is built and established, the transition involved in replacing or adding lab instructors is eased. With the institutional knowledge of the laboratory equipment and experiments documented in the videos, a new instructor can quickly bring him- or herself up to speed with the lab course and continue to use these videos to familiarize the students with the experiments. Similarly, the videos can be used to train graduate students who will be serving as lab assistants.

## STUDENT FEEDBACK

At the end of the first course that used the pre-recorded demonstrations, in an anonymous survey about the course students were asked the following question: “Question 12, Essay. This was the first quarter that the experimental demonstration/walkthroughs were delivered via pre-recorded videos. What did you think of this approach? Was it helpful? Do you prefer it to the previous method (in-person verbal demonstration given to the group before they left from the previous week’s lab)? Are there ways it could be improved?” These students had all taken previous unit operations laboratory courses that used personal walk-throughs to introduce upcoming experiments. The feedback regarding the videos was overwhelmingly positive. Some of the responses are given here:

- “I really loved the videos being available instead of an in-class walk-through, mainly because I could re-watch them while writing the lab reports.”
- “The videos were very helpful in the sense that one could pause and rewind at any time to review the demonstration procedure.”
- “I do think the videos are effective in getting the information out to the class. The ability to watch them more than once is a big plus.”
- “I thought the videos were very effective. It allowed us to watch the video over and over again to familiarize ourselves with the process as much as possible.”
- “I thought the videos were extremely informative and helped me get a better understanding of the experimental procedure.”

Of the 17 students surveyed, none stated a preference for the previous method of providing tutorials. Unfortunately, there was no quantification involved in this topic of the sur-

## *Students can watch the videos in an ‘on-demand’ setting, pausing and rewinding the videos as needed while watching them at their convenience.*

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vey, nor were any objective, quantifiable tests administered to students in the course before and after the introduction of the video demonstrations. My own experience with the students suggests that changing the delivery method of the experimental tutorials from personal to video has improved their preparation (or at the very least hasn’t worsened it), but this is purely subjective and anecdotal. While having objective data to support these observations is certainly desirable, I have found using the videos helpful enough that I am resistant to the idea of going back to the previous method of giving personal tutorials for the sake of administering such tests and collecting these data.

Making pre-recorded video demonstrations of laboratory experiments available to students before they perform the experiments can make time spent in laboratory courses more efficient for both the students and the instructor. Given all the benefits cited above, I have found the videos to be well worth the relatively small time investment needed to film and edit them.

## ACKNOWLEDGMENTS

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