

## Project Year

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## Project Title

Video Tutorials as a Digital Pre-Lab Preparation Tool

## Project Team

Orla Wilson, Whiting School of Engineering, Materials Science and Engineering, Faculty

Michael Karweit, Whiting School of Engineering, Faculty

Alexander Dang, Whiting School of Engineering, Materials Science and Engineering, Fellow

Andy (Chao An) Tien, Whiting School of Engineering, Computer Science, Fellow

## Audience

Students in the Materials Science and Engineering undergraduate lab classes (510.428, 510.429), *What is Engineering* (500.101), and the Whiting School of Engineering's STEM summer program, Engineering Innovation (EI).

## Pedagogical Issue

The global objective of any undergraduate laboratory class is to design experiments and give the students tools which will enable them to learn to think scientifically. There are certain concepts inherent in all laboratory classes that students have difficulty mastering. Concepts such as error minimization, analysis, propagation, heat transfer, statistics, and separations fall under this umbrella. Traditional lab preparation involves reading a lab manual and answering pre-lab questions, which is not always sufficient to enable all students to approach the lab fully-prepared.

## Solution

We propose the development of a series of 10-15 minute video tutorials, in the vein of the Khan Academy, to serve as a digital alternative to traditional lab preparation exercises. It is not the goal of the videos to demonstrate a particular lab technique, but rather, to ensure that all students are given the opportunity to completely familiarize themselves with the concepts implicit in the upcoming lab. This enables students to approach the lab with an inquiring mind. We will assess two different formats for developing these tutorials: Adobe Captivate and video recordings on the chalkboard during the development phase.

## Technologies Used

Adobe Captivate

Animations

Video Recordings

## Faculty Statement

In a typical undergraduate lab class, students work in groups – the lab class is one of the most important classes in terms of learning and fostering the ability to work in a group. There tends to be one strong group member who takes the lead, and one who takes much longer to fully appreciate the objective of the lab and can't conceptualize the problem. The instructor is left with two options in this situation –

s/he can make it clear that the student is expected to learn the concepts on their own, or the course can be watered-down and simplified to the detriment of the syllabus. Obviously neither situation is ideal and we believe that our proposed improvements will go a long way towards ensuring this situation does not occur in our undergraduate lab classes. By enabling the weaker student to come to lab prepared to tackle the problem scientifically and analytically, we will not only be improving the learning experience for that student but will also be enhancing the group-work ethos.

Students will be expected to watch the video tutorials prior to lab class, either on their own or with classmates. Ideally each lab group will watch the tutorial together and come up with a plan for the lab, thereby using the tool to encourage collaborative learning. Our proposal is a novel addition to the lab curriculum but importantly does not take away from valuable class- or lab-time.

As a prototype, three 10-15 minute video tutorials will be developed for the following 3 labs: (1) remote measurement and error estimation (2) mechanical testing of materials and (3) chemical processes. Through this first phase of development the desired outcome is that students will come into the lab better prepared than if they had simply read the lab manual. This will put them in a more favorable position to think scientifically about the matter at hand and work more cohesively as a group. We will pose questions; work through different scenarios to make students think about, for example, the consequences of using one measurement technique over another that may be easier but less accurate. By working through examples and demonstrating how the error magnifies depending on how measurements are made, the students will be able to decide on the most accurate and precise way of approaching any lab.