A Kendall Center Mini-Grant Proposal – Transforming Learning, Teaching, and Research in Chemistry with Google Glass

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Overview

I believe that wearable technology like *Google Glass* carries the potential to transform the ways professionals in the physical sciences learn, teach, and do research. With the continuing spread of smartphone and other mobile technologies into homes, offices, classrooms, and laboratories, interactions with information are becoming increasingly rich and dynamic, and the time from identification of desirable information to *consumption* of that information is approaching zero. However, to fully capitalize on the potential of these technologies for consuming information we must leverage emerging technologies for *production* and *acquisition* of high quality information that meets the needs of current students and researchers. I believe that *Google Glass* is an example of wearable technology that will transform my ability to *produce* and *acquire* high quality information, primarily in video format, for use in my teaching and research. This new ability will both enhance the learning experiences of my students by providing richer technical learning resources, and improve the quality and productivity of my research laboratory by streamlining documentation of experiments and teaching experimental techniques to new students. With the support of this mini-grant I will purchase *Google Glass*, focus my effort on the use of *Glass* to address specific learning, teaching, and research objectives, and share my experience with the Gustavus community (and beyond, as warranted).

Background

A critical component of teaching and learning in chemistry involves the development of hands-on laboratory skills. Learning these skills is best facilitated through live demonstrations of these techniques, however this is inconvenient in some situations for a variety of reasons, and it is highly desirable to have a set of videos showing these techniques that students can consume at any place, at any time, as much as they like. Along with the decrease in cost of modern video recording equipment, a number of educators have begun to make this kind of video content available through YouTube and other channels. Some of these video demos (produced by Prof. Christopher Harrison, San Diego State University) have been viewed hundreds of thousands of times in the past two years. Delivery and consumption of this content has become commonplace, and is relatively straightforward. However, production of this content is still quite cumbersome because two hands are usually required to demonstrate the skills of interest leaving zero hands available to manipulate the video recording equipment. The introduction of technology like *Glass* simplifies this process by making both hands of the person demonstrating the skill available while simultaneously recording video where the focus of the video naturally moves with the eyes of the person doing the demonstration.

In any research laboratory focused on the physical sciences we encounter a different set of challenges that dampen productivity. A large part of the effort of any physical scientist is devoted to documenting their research experience in enough detail that someone else can repeat the experiment. In the case of complex experiments this takes an in ordinate amount of time because of the number of words required to adequately explain the setup of the experiment and any observations that are made. The ability to record this process with video while leaving the experimenter's hands available to manipulate the experiment has the potential to revolutionize this documentation process.

Objectives

1. To evaluate the effectiveness of *Glass* for recording demonstration material related to teaching and learning in an experiment-intensive chemistry course
2. To evaluate the utility of *Glass* in a chemistry research laboratory setting where documentation of experimental apparatus and results will be made in video format

Deliverables

Materials related to teaching and learning

- I will prepare a series of tutorial videos for my Che270 course that demonstrate fundamental laboratory techniques used in the course.
- I will experiment with the use of Glass in my classroom to provide a richer 'demo' experience by allowing the students to 'see what I see' – I will project what I see through Glass using an overhead projector so that the students can see me *and* what I see

Materials related to research and scholarship

- I will prepare a series of videos documenting the experimental apparatus, observations, and results associated with analysis of complex samples by two-dimensional liquid chromatography in my laboratory
- I will prepare a series of videos documenting the process of preparing liquid chromatography columns at high pressure (e.g., 10,000 psi) in my laboratory – this is an inherently dangerous operation, and having a series of videos like this for training purposes will improve safety for everyone working in my laboratory

Dissemination

- I will organize a Teachers Talking Technology session to share my experience with the Gustavus campus community.
- Provided I have a positive experience, I will prepare a manuscript describing my experience and the products of this work (e.g., learning materials) for submission to the *Journal of Chemical Education.*
- All of the video material produced as part of this project will be available to Gustavus students through my website, and more broadly through YouTube.

Timeline and Cost

The current cost of Glass is $1500 to developers (dubbed 'Explorers' by Google). If I could buy *Glass* tomorrow I would look to complete the work proposed here by December 31, 2015. However, currently *Glass* is not available at any price because Google sold 15,000 units on April 15th. There are no publicly announced plans to sell more units. The current rumor is that Google may release *Glass* to the public this summer. At this point my request, if this project is approved, would be to have the funds available so that in the event that Google does another 'one-day sale' I can act quickly to purchase *Glass*.