

Grant Proposal of Innovations in Teaching Using Technology

Yang Yang

1. Title of Proposal: Virtual Chemistry Recitation for Problem Solving

2. Courses(s) or Curriculum Affected: CHEM 06100—General Chemistry I; (second phase) CHEM 08305—Biophysical Chemistry; (future) any course where problem solving is an essential component.

3. Name of Applicant(s): Yang Yang (Tenure-Track Assistant Professor of the Department of Chemistry and Biochemistry of Rowan University)

4. Objectives of the Proposal—Motivation and Importance of Innovation:

Teaching is an art, an art of flowing educational information logically and naturally. An effective and efficient teaching is never trivial, which depends not only on the teacher's knowledge of the discipline itself, but more importantly, on how successful a teacher could dissect a big and intricate problem into small and more digestible pieces. Over 10 years of teaching experience educates me that *examples* are catalysts to information absorption, which is particularly true for science and engineering majors. Without vivid examples, abstract equations and concepts are *cold* to students.

As a tenure-track assistant professor of the Department of Chemistry and Biochemistry, I have been teaching General Chemistry I (both lectures and labs) at Rowan University for a year (since Fall 2011). The course is designed for students majoring in chemistry, or another science requiring an equally in-depth knowledge of chemistry. Practically, for most of students, General Chemistry I is their first science class at Rowan. As students of an American Chemical Society (ACS) certified program, they will take the ACS standard exam as their final, which covers 11 chapters, ranging from basics of chemistry to complicated structures of atoms and molecules.

Although I have taught General Chemistry courses several times before joining Rowan, I came to realize that completing 11 chapters in one semester is never an easy job. A vast amount of knowledge needs to propagate. Examples are given in class to illustrate each new concept and equation, but are not sufficient due to the limited lecture time. Unlike a large research institute, where, besides professor's lectures, teaching assistants lead recitations for problem solving, we apparently miss such occasions to provide additional examples with guidance, which certainly needs to be improved and augmented as soon as possible.

In summary, the bottleneck is to teach a large amount of knowledge in limited time with a relatively small number of teaching staff.

5. Description of the Specific Innovation: Here I propose to design a virtual (online) chemistry recitation for problem solving with iPad to specifically address the teaching deficiency discussed above. After each normal lecture, I will post a short video online to demonstrate 2 to 3 representative additional examples for applications of new knowledge.

The examples will be tightly coupled to the lecture materials. Problem solving skills are particularly emphasized, which is critical for students to pass ACS final successfully. The idea of such an online course is classical; however, the techniques in this proposal fulfill the goal in a *revolutionary* way which has never been applied as a routine teaching component on our campus based on my best information.

Detailed scheme is illustrated as below:

- a. Mac iPad is the only technical hardware for this realization.
 - b. A FREE App of *Educreations Interactive Whiteboard* (version 1.2, released on June 13, 2012) developed by Educreations, Inc is used as the software platform. *Educreations* transforms traditional iPad into a recordable whiteboard. Teachers could write examples on the screen, and simultaneously, the App will record the teacher's narration along the problem solving process. The finished entire recitation (handwritings on the screen and the recorded oral discussion) is saved as a flash video and is conveniently uploaded to educreations.com, where the teacher has the option to share privately or publicly. In my case, I will post the video link at Blackboard for students to access. It is also the teacher's choice to embed the videos into blogs or share them on Twitter or Facebook. This App has been rated as 4.5/5 at www.apple.com based on 580 customer votes. More specific technical details of *Educreations Interactive Whiteboard* could be found in reference 1. For virtual recitation demos, please refer to reference 2.
6. **Required Instructional Technology Support:** The virtual recitation can be accomplished by each individual lecturer through the easy setup of iPad with Educreations. No additional technology support or sophisticated hardware is needed. No specific teaching environment is required. Teachers could prepare the virtual recitation in the office or at home. The generated video can be uploaded to the host website through the Wi-Fi wireless internet access immediately.
7. **Objectives of the Proposal—Scalability and Adaptability:** In my current proposal, I am planning to practice it in my General Chemistry I class for the coming Fall semester (Fall 2012). Valuable experience is expected to be accumulated through online references reading, personal practice, peer professor discussions, students feedbacks, etc. Specific survey of this virtual recitation will be designed for students to help further optimization.

With gathered experience from my General Chemistry I class, I propose to extend the application in my other classes, e.g., Biophysical Chemistry, which is a requirement for Biochemistry majors and serves as an upper level elective course for Biological Science majors. Once the practice becomes mature, I am open to share all of experience in our department and campus-wide. In principle, the current innovation may benefit any course where problem solving is an essential component, which is the case especially for most of the science and engineering courses. The present proposal matches the rapid development of Rowan University in science and technology and is consistent with the University philosophy to maintain high-quality teaching. For example, based on the IRP Common Data Set, for the past 5 years, the enrollment at the University has increased by ~17%, among which, Chemistry and Biochemistry majors increase by 64% and 248%, respectively (nearly 4 times and 15 times greater than the university growth during the same time span correspondingly). The proposed innovation will serve as a generic model for virtual

recitation, and is not limited to any specific discipline. Due to the ease to use and the high quality-price-ratio in teaching augmentation, I have no doubt that the proposed innovation will be readily scalable to many other departments, especially considering that iPad has become an integrated part of everyone's life. More and more students will benefit from the virtual recitation via convenient "clicks" of the online videos.

Some other highlights are emphasized as below to demonstrate how the proposed iPad-based virtual recitation serves as an ideal solution to our present teaching challenges:

- a. **Availability:** helps instructors to reach more students out of class.
 - b. **Specificity:** is specifically coupled to our lectures at Rowan.
 - c. **Responsibility:** has a clear objective to provide representative additional examples, and is not designed to replace the normal lectures.
 - d. **Flexibility:** allows students to access the resource anytime anywhere.
 - e. **Repeatability:** can be used repetitively by current and future students.
 - f. **Enjoyability:** it is easy to follow and fun to watch.
 - g. **Affordability:** it is an inexpensive (see budget in section 9) and high-return investment.
8. **Plans for Evaluating and Sustaining the Innovation:** Student performances on midterms, quizzes, finals, homework, etc. can be used to judge their understanding of course materials. These results will be compared with those from previous years to evaluate the innovation of the virtual recitation. It is worth to note that the ACS standard final exam (multiple-choice based) result will serve as a rigorous and quantitative evaluation. Besides General Chemistry I, ACS standard exams have been utilized in our department for General Chemistry II and Organic Chemistry II. For the academic year of 2011-2012, 35 sections of students took this type of exams. More chemistry courses are expected to apply the ACS standard exams in the near future. In addition, feedbacks from students survey will also play a critical role to help evaluate the innovation. The App of Educreations Interactive Whiteboard is user-friendly. No specific technical training is needed to grasp this software fluently. Once the innovation is ready to propagate campus-wide, I could develop a virtual tutorial to illustrate this application, which will be specifically designed for teachers at Rowan based on my own first-hand practice experience. Along with ease of use, all of these activities should make the innovation quite sustainable.

9. Budget:

	Item	Number	Price
Hardware	Mac iPad 32GB Wi-Fi ³	1	\$599.00
	iPad Smart Cover ⁴	1	\$39.00
Software	Educreations Interactive Whiteboard (version 1.2) ¹	1	Free
Video Host	www.educreations.com	N/A	Free
		Total	\$638.00

Reference:

1. <http://itunes.apple.com/us/app/educreations-interactive-whiteboard/id478617061?mt=8>
2. <http://www.educreations.com/>
3. http://store.apple.com/us/buy/home/shop_ipad/family/ipad/new_ipad
4. <http://store.apple.com/us/product/MD310LL/A>