Stem Proposal for Chemistry

**Purpose:** To move students from being mere consumers of content to being creators of it.

**The tools:** We are requesting iPads and MacBooks and the supporting software and hardware.

**How will iPads make the chemistry teaching and learning at Cerritos better?**

We will use the iPads to do many things we cannot currently do. In chemistry there are lots of 3-dimensional models that teachers and students attempt to draw. Using the iPads students will be able to draw and label molecules and see the structures in 3 dimensions. Also the instructor will be able to assess as you go (formative assessment). There are fine details that students often miss in molecular diagraming, currently on 2-dimensional paper. But with iPads the student’s work can be projected onto the screen immediately. The iPads can be loaded with an app called “iSpartan”. This will allow students to build the molecules and study their spectroscopy, 3-D structure and rotation, R and S configuration and even see the NMR spectra. We could also analyze bond angles and bond length and steric strain. We can visualize hydrogen bonding and how molecules interact. We could also do crystallography measurements. We cannot currently do this. iPads can also be used to go to the higher end of Bloom’s taxonomy. For example the students can create videos and presentations. In the lab students could produce electronic lab reports. Using the iPads students could take video and annotated photos of their lab experiments. They could then compile these into a video lab report that demonstrates student understanding of the process. They could also perform time-lapse photography of their experiment. Currently the students passively watch the experiment and then do a hand-written lab report. Procedures for lab reports could be flowcharts created on the iPad. Jeff Bradbury and Michelle Narvarro are currently working on a student contest. One goal is to develop the creativity of our students and make it more high profile. We plan to have the students present a science topic in a creative format which may use technology such as video and possibly creating an iBook. The iPads and MacBooks would be an integral part of that project as the students may check out the devices while and work on their project while faculty are present.

The times are changing. We have seen other institutions merely videotape their classes (in some cases 10 years ago) and put that on the web. This is not bad, but it could be so much better. It is not enough to just adapt or shape what is currently done into the new media format. Content has to be completely rethought redone in new ways that tailor to the internet environment. It is not enough to just video tape a person standing and talking for 90 minutes. The content must be presented in a way that works best in the online format and in a time frame that is best for that environment. We need to start experimenting now or we will be left behind by the innovators just like oral teaching was supplanted by books in the 1500s. We are at a pivotal point in the history of education. In some ways we are not just talking about a new delivery system of the same content, we are re-thinking the whole purpose of education. For example is memorizing large chunks of content appropriate when that information is so available on the web? This time of information digestion is called “Just-in-case learning”. It is knowledge that you memorize just in case you need it someday. But now with the world at our fingertips we can have “just-in-time knowledge”. We can access knowledge when needed. So memorizing (although some of this is still important) is not the main thing. Today’s technology lets our students, and us, develop entirely new skills. Our educational values can also be rethought. For example developing students’ creativity is a value that has taken a back seat in the science class. Creativity is a necessary skill for our students. Technology allows us to put the development of creativity front and center as well as problem
solving. Using technology education can become more individualized. There are algorithms similar to those used by Google and Amazon that customize your marketing that can now customize educational experiences. Some have suggested that there may even be new student learning styles yet to be discovered. Currently, courses are designed around “time in seat”. But with technology courses can be designed around mastery of knowledge for each and every student. This is the direction education is moving. We need to take the leap. Technology is not the center, it is simply the tool. However technology allows us to do new things with new values, with new ways of thinking. This is not just tinkering with education around the corners. It is not like going from a 2000 model of a Ford to a 2013 model. IT is more like going from a 2000 model of an automobile to a Lear jet. It is a whole new set of capabilities. So just as we cannot completely measure the value of a jet with the standards used with an automobile, it will be the same with new education models.

We hope to get to the higher end of Bloom’s taxonomy has shown here in a diagram by Kathy Schrock. (http://www.schrockguide.net/bloomin-apps.html)

Will students be issued an iPad to take with them.

Initially we plan to use the iPads on campus only at first. We really want to see how the students interface with the technology. Cheryl plans to use the iPads in the lecture setting and Jeff in the lab. Although we will both experiment with the iPads in all settings. iPads will be checked out to students to work in the computer lab during hours in which Jeff or Cheryl are present. Students could check out the iPad or MacBook to work on projects like the proposed contest that Jeff and Michelle Navarro
are currently putting together. Possibly by the third year we may consider checking the iPads out to a class of students to take home.

Don't we already have iPads?

Cheryl and Jeff both have iPads. Jeff has had an iPad since 2010 and Cheryl since early 2012. Both have worked on implementing it into instructor-only use. Because we currently do not have WiFi iPads have not been very useful in the classroom. Outside the classroom Jeff has created a Showme.com page of Screencasts for his Chem. 100 students. They have had over 13,000 views at the time of this writing! Jeff’s students have found it quite beneficial in helping them review material. Students have emailed Jeff with a question on the weekend about a problem and within 10 minutes a video can be posted giving a mini lecture that the student can watch over and over again. Jeff would like to have the students now create the Screencasts. So now we want to go to the next level from one iPad in the classroom that is used by the instructor to where the iPads are in the hands of the students. One goal is to go from the current model of students just taking notes in class to students being more engaged in their learning process. One thing we envision would be assigning each student or pair of students a different problem. They then create a screen cast video. We must be completely forthright. We do not know exactly where this is going. The students will come up with ideas for the uses of the technology we have not even thought of. For example Jeff’s 10 year old explained to him how to use Doceri! The students are already “wired” to think differently about using technology. They will probably teach the instructors just as much as they learn from the instructors.

Will these iPads sit on a cart in a back room somewhere?

As mentioned, Jeff and Cheryl have considerable experience with the iPad. Jeff sits on the California Teacher Advisory Council. He was issued a personal iPad to go and explore. The council is now making recommendations about innovative technology in the classroom and sharing this with symposia to University Presidents, CEOs and government officials. Not only will the technology be used, but what is learned through failure as well as success will be shared to people at multiple levels. Jeff has demonstrated his use of innovative technology for close to a decade. He developed screen casts using a tablet beginning about 8 years ago and has been helping his students and the students of other faculty with his “mini web lectures.” This is similar to the very popular Khan Academy. Jeff and Cheryl both worked with a grant that provided Palm hand-helds about eight years ago. So both have used technology in the classroom for many years. Cheryl was the main Cerritos person involved with the PT3 grant in the early 2000s. That grant was in conjunction with our teacher TRAC program. The name of the grant was Preparing Teachers To use Technology. She purchased hardware and she implemented an extensive professional development program to go along with it. Both Jeff and Cheryl have attended the CUE conference as recently as March 2013 in order to stay on the cutting edge with the uses of technology, specifically iPads. Jeff and Cheryl are both committed firstly to our students and then to the appropriate use of technology and mentoring colleagues in using technology.

Will the technology drive what happens in the classroom?

We believe in getting the order right: students, content, tools. Since the early days of PT3 we have held strongly to the notion that technology does not drive education, students and content drives the education, technology is the airplane that gets us there. Although with the use of technology we now see places we can go that were previously not reasonably possible.
Will other faculty be able to use the iPads or just Cheryl and Jeff?

Collaboration, collaboration, collaboration! We hope this spreads so we definitely want to share with other faculty in our building....even biology ;) We think that when different minds see the same thing, different ideas come out. So we would love to have other faculty try the iPads and learn from them.

What is the technology we are requesting?

- **60 iPads** with cart We need two class sets since Cheryl and Jeff will be using them and they will probably be using them at the same time.

- **8 MacBooks** These laptops will be needed for several purposes. First, to interface with the iPads in the lecture, a MacBook is needed along with “airplay” software. This set up allows for any iPad at any time to be projected directly onto the screen through the MacBook. The laptops are also needed to sync the iPads. Lastly we would like to eventually have the students create their own textbooks. We would like to take flipping to a new level. Instead of students merely reading parts of the text here and there if that. WE would like to have students create their own books. iBooks Author is an excellent tool on Macs that allows for students to create their own books. These are not traditional books at all. These books which can then be put on the iPads can include video, slide shows, quizzes, 3-d images and podcasts all within the eBook. At this point the best place to create these iBooks is on a Mac. Spartan app is 19.99. These laptops would be available to students who want to use them to work on their project for the contest in the works by Navarro and Bradbury.

- Money for relevant apps. (Pages, Keynote, Numbers, iMovie, iSpartan, Chemdoodle)

- Money for applications on the MacBooks (Office, iWork, iMovie, Spartan, Odyssey, Doceri, Airplay, Chemdashboard, iMole)

- (Later) Probes (temperature, pH, pressure, gas chromatography, voltage, conductivity, etc.) Many probes can be interfaced with the iPad which then collects the data and processes it and allows fro graphing.

- What could be done with the iPads?
  - Utilizing apps in the classroom
  - Creating Screencasts (such as “Educreations and” Showme” or “Explain everything”) as a form of assessment and demonstration of knowledge. These could be stored and utilized to help later students.
Creating multimedia lab reports. Lab reports could contain video, pictures with narration and annotation.

Quizzes could be taken on the iPad

iPads could make lecture more interactive by using a “clicker” or survey app.

Students could present their work to the whole class using “airplay” and Apple TV.

Data collection and interpretation with temperature probes and other probes designed for iPads

Graphing experimental data

Accessing information on the web

Accessing eBooks developed by instructor and students

Create and edit videos/slide shows and animations

Create flow charts and graphic organizers

Create eBooks/iBooks using appropriate apps

Accessing Spartan app which has chemical data and allows students to draw molecules and analyze them

Research!

Collect data on the web and analyze it

Students could annotate PowerPoint presentations or lecture notes and take notes in class on the device.

Students could dictate lab notes using “dragon dictation” and it is transferred into text. This allows for hands-free data recording

Instead of just doing problems on paper, students could record and capture, with voice over, their work for later study use.

Students could create “digital flash cards or video flash cards.”

Accessing stored documents on “the cloud”.

Students could create a presentation and then immediately present it to the class. This gives the students ownership and the teacher a better facilitator.

What would be done with the MacBook

Manage/sync iPads

Create multimedia presentations
o Create iBooks using iBook Author which cannot yet be created on the iPad. iBooks are amazing. They will eventually replace textbooks. They can contain text, video, slideshows, quizzes, audio etc. They can be created by the instructors or by students.

o Make it possible to project any iPad onto the screen during lecture using “airplay”.