Conversations on Technology: Using technology - is it worth it?

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Question #1:
"I know that incorporating technology has taken an investment of your time. Before I dive in, I need to know... do you think it has been worth it? Did you accomplish with your students what you wanted to accomplish? I don't mean to sound skeptical, but how do you know?"

Well, some of the "worth it" part is a practical consideration. Using technology as a way of communicating with my students has made information more accessible to students and communication easier. Let me give you some examples. If I am busy or hard to reach my students can surely communicate with me any day of the week via e-mail. Using a web page disseminating information in my classes has decreased the number of students who say they couldn't get information about assignments, expectations, deadlines, etc. Putting an outline of up-coming class discussions and notes on the course home page has facilitated discussions during class meetings. Rather than copying my overheads furiously, the students fill in the spaces and spend the rest of the time interacting and thinking. Posting something I call "Questions of the Day" on the web prior to class meetings has helped students prepare for class discussions. Does this make students learn more and better? I'm not sure... but I do know it makes taking my classes a more uniform experience for everyone and it frees up some of my time. My suspicion is that students note taking is probably much better.

It is worth it, and, in the long run, unavoidable. It helped accomplish my goals, which are very rarely fully realized. It freed me of time taken drawing what are often bad pictures or slowly writing theorems in poor hand writing. It also forced me to be better organized. It allowed for increased communications since students could submit questions at anytime and get answers when I was able to have time at a computer, even while traveling. How do I know it helped? My evidence is purely subjective based on many years experience in teaching the subjects.

Well, I'm a skeptic myself. Most technological interventions in the classroom seem worthless to me and I don't bother with them. Once in a while technology allows you to do something you couldn't otherwise do, such as deal with a
large data set or a complex modeling problem that must be handled numerically. This kind of exercise is very useful to the extent that it embeds the mathematical problem in a real world setting. I know it is useful because of interview data from the students themselves. I know the students understand the point of the computer assisted exercise because they are always asked to write extensively about it. Sometimes technology allows for experimentation or visualization that helps with the understanding of a phenomenon. I don't have data from these sorts of uses, so I can't swear it was better than some other alternative, except that I was unable to come up with an alternative.

**Yes, it has been well worth it.** I make substantial use of Excel® in one course and Maple® in another. In both cases, the students respond very favorably. The use of Excel® has been especially successful. Many students have told me they have used Excel® extensively after the course ended, including in the jobs they have obtained. I also know that they have a better understanding of how the mathematics taught in the course is actually used. I see them using the tools, in ways that are impossible without the technology.

**There is an initial investment of time that is offset later.** Once you have developed the materials and learn how to use them effectively it takes a lot less time. I know it works because students perform better in assessment of understanding.

**Wow, this is a hard question.** I think that every minute I invested to incorporate technology in my courses was worth it and I would do it again. However, one cannot know the amount of investment when one starts. It is huge and all consuming. It is like a love affair, a passion that you cannot turn away from once you seriously start.

**With regard to accomplishing things with students...hmmmm.** That is a mixed bag of observations. Students are so variable. However, I can offer some observations and these may help. The first computer I got for p-chem lab was so welcome that students stood in line to use that 286. I had to give permission for security to let them in the lab to do homework. They loved the multicolor graphs they could prepare with the plotter. Later I got a 386 and color printer. That was even better. However some students were afraid to use the computer. They were very unsure of their skills and needed a lot of help to get started. This goes back about 10 years and I still find students resist the machines because of their lack of experience. One of the problems is that they
see it as another task that adds to their burden of study rather than a tool to use to learn better.

Well how do I know what students are accomplishing? This is a moving target question. Once I get one problem solved the problem changes and new challenges appear. First was the spread sheet problem. Students learned this and then the software got more sophisticated and I had to change the method of instruction. The software moves and then I move and then the students move to learn. The important thing is to set reasonable goals and then match challenge with support. I spend a lot of time with the students helping them to master software so they can get on with the job of using it to learn chemistry. I am committed to this because they will need to constantly learn software throughout their careers. So perhaps we should teach them how to learn on their own and get out of their way so they can learn. It is important to match challenge with support. It is important to let them have time to grow. Most come to p-chem with poor computer skills. My students now are doing amazing things with symbolic mathematics software. I help a lot but they are starting to teach me things. That is how I know they are successful. I listen to the types of questions they are asking me. The questions get more sophisticated as the use the software in conjunction with studying chemistry. Software usage in context of the normal curriculum. It is just like learning to use a calculator. I also know because the students teach each other. I must sometimes step back and let them do this. I have seen real growth in the class this year. Growth from resisting my unorthodox methods of teaching to acceptance and now even looking at my demands as a challenge. But I match challenge with support and sometime need to give them a day in class to just unload all their software questions or work on homework in class.

My goal in using technology is two fold:
1. Spark student's interest.
2. Explain concepts better.

Students, especially in my intro chem class, always respond positively to my use of technology in their evaluations.

I'm not sure yet, we are just starting to implement the most aggressive approach to IT in the CS 310 class.
Yes it is worth it--I accomplished what I set out to do, and the results were verified by comparing the scores of the traditional approach to the class using technology.