Beyond PowerPoint®: UGather® and UPresent®
Bring Innovative Multimedia into Large Classes

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Rick Peifer
Assistant Director, General Biology Program
University of Minnesota
Minneapolis, Minnesota

Why use technology?
I began thinking about using visualization as a technological aid more than a decade ago, as students in our introductory biology courses struggled to understand the developments and discoveries in molecular biochemistry -- the structure of DNA, molecular and cellular processes, protein synthesis, biochemical reactions, and such. Learning such complex concepts, involving processes at the molecular level that students can’t readily see and touch, is a real challenge for them.

Yet when they see visual representations on a computer screen of structures and processes – seeing, for example, the interaction between the structure of an enzyme and a substrate – and then see the interactions of whole groups of enzymes, they get an insight into the relationships and functioning of these structures that they could not possibly grasp from seeing numbers on a page. In the same way, a molecular biologist studying the structure of HIV at the nanometer level can say, “Look at that groove in there – we might be able to go after that target and inhibit this enzyme.” The same sort of process can translate into the classroom.

The strategy
It literally is true that a picture is worth a thousand words – but a computer animation of an abstract molecular process is worth even more. When Apple Computer introduced its first Macintosh computers, with their graphic capabilities, I really became interested in creating engaging, diverse multimedia content to bring into the large classes, particularly in our large lecture auditoriums, which seat from 400-800 students.

I discovered from research in cognitive psychology that illustrations can significantly improve students’ learning; but the research also told me that students need guidance and prompting to process illustrations and place them in the proper context. All through our project we’ve felt that it’s very important to keep faculty and students engaged and working together when using technology – our goal was never just to create something that you put on a computer and send a student off to learn it. We want to encourage and enhance the quality of teacher/student interactions, not limit them.

I applied for and received a large internal grant here at the University of Minnesota, as part of an initiative for improving the quality of undergraduate instruction in big classes. That paid for retrofitting the auditorium with projectors and computers. It also paid for a nucleus of a workstation in our office. We began to develop sophisticated illustrations that our faculty integrate into their classes and help the students analyze during lectures. We also began to develop animations – of chemical reactions and viral replication, for example – which are even more powerful for representing structures and processes.
The courses
Our program is responsible for three introductory biology courses – Biology 1001: Evolutionary and Ecological Perspectives; Biology 1002: Molecular, Cellular, and Developmental Perspectives; and Biology 1009: General Biology – that satisfy the biology requirement for liberal arts majors and also satisfy requirements for the biology major. The program serves about 4,000 students each year. Two colleagues and I maintain the program as instructional staff (status equivalent to teaching faculty). We provide technical support for the biology faculty who teach in the program, we teach, and we do science education research as well.

The learning technology
Multimedia library: We first established a rich library archive of these multimedia graphics – sophisticated illustrations, animations, photos, electron micrographs, videos, and more – for our faculty to use. As an example, in the early days we created an animation that combines glucose and fructose to make sucrose. Using Macromedia Director, an animating software for the Mac, we displayed the detailed molecular structure, but we could use the computer to dissolve away the layers until we got a more abstract representation of the structures, leaving only the hydroxyl groups.

In contrast, if we show a standard illustration or draw something, no matter what we show, the students will worry that they have to remember everything. With the computer, we can dissolve away the detail, focus their attention on the key concepts – such as the hydroxyl groups – and say, “This is what I want you to remember. This is what is important – this is a ubiquitous process by which things get linked together throughout all living systems at the biochemical level.”

We’re constantly adding to this archive, which contains thousands of computer graphics, animations, and QuickTime movies. With the advances in technology, now we can have instant graphics, animation, and digital video come right to the computer screen. And over the years colleagues have given us permission to use their animations and magazine-quality photographs. For this reason, for now, we have to keep the library proprietary to the University of Minnesota. But we hope to make some of it public in the future.

UPresent®: We realized that faculty needed a way to organize the graphics into presentations, so we created UPresent®, a Macintosh-based application for multimedia presentations. UPresent® allows faculty to assemble multimedia in any sequence for a custom presentation. Developed long before PowerPoint® came on the market, UPresent® enables faculty to create multiple presentations in a data file and move among them during a presentation. The software has a script editor to organize the presentation; users can add text, view live video, or run automated slide shows with graphics and QuickTime movies.

UGather®, a Mac-based software for multimedia management, is a companion to UPresent®. UGather® lets you set up, store, and search through custom databases of graphics, images, video, QuickTime movies, text, and audio files. Then you can select the multimedia you want and automatically load it into the presentation you created in UPresent®.

Our General Biology Website contains multimedia examples and guides, World Wide Web resources and links, and information for students about the introductory biology courses we offer. Our students can also access their grades on the site. The “News in Science” component
links course material to daily news stories, showing students that science really is relevant to their daily lives.

The hardware we use – computers, video cameras, projectors, and such – all allow us to do extremely innovative things in labs. For a DNA science laboratory that I developed for our General Biology course last year, students isolated their DNA from cells scraped from the insides of their cheeks. They amplified the DNA using PCR (polymerase chain reaction), a biotechnology technique for doing massive replications of DNA, and ran gels that show what DNA is present. We figured out how to digitally image that and move it right into our presentation software, so immediately we were able to project their gels up on the screen for discussion.

**The project support**
In addition to the original large grant that got us started, we’ve received other internal grants – the University of Minnesota is committed to supporting this technology. We also received an NSF grant to populate one of our teaching laboratories with a computer for every two students, to get them to work cooperatively – for this we wrote a whole new curriculum using wet labs integrated with computers for data collection analysis, modeling software, and so on. In addition, the students pay a technology fee that helps fund Internet access and some of the computer equipment.

**The results**
When we asked for the students’ perceptions of what they were getting from our courses – did they appreciate the uses of the technology, did they think it helped – hands down the answers were really good. Students have used UPresent® to present their research projects to their peers; they also have put the projects up on the Website.

Over the past decade, we’ve learned that there is a potential for misuse of the technology. For example, every so often someone will come in, grab all this stuff, put it together, and just show it – and you can see that they haven’t got a clue about what they’re going to say about it in class. When they get in lecture, they’ll bring up a graphic, stare at it, and wonder, “What was I gonna use this for?” It’s really obvious when people do that. So there is a potential for abuse and misuse.

But someone who has a passion for the subject they’re teaching can take this technology and really make it shine in the classroom – and help the students in a positive way. The goal is to be thoughtful and selective about what graphics you need to use in class.

I get pretty upset when I see what I call a text outliner-presenter, like PowerPoint, driving the use of technology in classrooms. People use flying bullets and transitions and sound effects as a way to somehow entertain their audience. I think its bad pedagogy – if you’re going to throw text at students as a principle message in a lecture or interactive presentation, then give them a handout or put the information up on a Website. Let’s use computers for doing what they do best, and that is: 1) creating computer animations of abstract processes to help students grasp those concepts; 2) managing data better; and 3) allowing students to search and find what they need in a database or on the Internet. This motivates me even more to make sure the tools we’ve created get into people’s hands.
A demo version of UPresent® can be downloaded (http://www.codeblazer.com/) for free in either the Mac or Windows platform. The full version of UGather® in Mac format can be downloaded (http://www.codeblazer.com/) for free. And let me know what you think. My email address: rwpeifer@tc.umn.edu

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