a wide variety of different approaches are in use by the institutions represented at this symposium.

Many of the papers described efforts to introduce molecular modeling into existing courses. For example, both the University of Northern Colorado (Greeley, CO) and Clarke College (Dubuque, IA) use molecular modeling in the general chemistry course. Texas A & M University (College Station, TX) teaches molecular modeling in the introductory organic labs, and the University of Hartford (West Hartford, CT) teaches this material in an upper-level synthesis course. On the other hand, Lebanon Valley College (Annville, PA) incorporates molecular modeling into all levels of the curriculum through the laboratory work.

The same diversity was found among the schools that are introducing computational chemistry. The University of Michigan (Ann Arbor, MI) has added computational chemistry into several courses in its curriculum, but especially the Structured Study Groups, that are the basis of the Honors section of the undergraduate Structure and Reactivity course. Michigan State University also has been merging computational chemistry into existing courses and is developing an undergraduate specialization in computational chemistry.

The University of St. Thomas (Houston, TX) introduces computational techniques to students in the physical chemistry course, by doing normal mode analysis. Rather than attempting to integrate computational chemistry into existing courses, Valdosta State University (Valdosta, GA)is developing a new required course.

The symposium also included some industrial representatives. The Wavefunction Corp. (Irving, CA), well known for its modeling software, has developed a workbook with experiments and demonstrations for use inorganic courses, and a speaker from SUNY Oswego demonstrated a new, inexpensive molecular modeling program.

Many of the questions during the discussion concerned what level of the curriculum was best for introducing these sophisticated topics. Some speakers felt it was better to delay until students had enough background to fully understand what they were doing, whereas others proposed to introduce the material early in the curriculum, so that students would become familiar with these methods early in their chemical careers.

These symposia papers, and the discussion that accompanied them, raise some fundamental questions about the way that we teach chemistry. The argument that we should not teach advanced techniques, like computational chemistry and molecular modeling, until students have the mathematical background and maturity to better understand them, is both reasonable and attractive. The opposing arguments are, however, also very compelling.

It has become traditional to teach chemistry in a recursive manner, that is, to return to the same topic at different levels of the curriculum in increasing levels of detail. Perhaps the best example here is atomic structure. Very few students really understand the orbital diagrams in general chemistry, but these experiences lay the groundwork for a more in-depth treatment in physical chemistry and other advanced courses. Should a similar approach be used with molecular modeling?

General chemistry, and even organic, are mainly service courses, where students majoring in other sciences pick up enough modern chemistry to serve as a basis for their majors. Since these students don't normally take advanced chemistry courses, can we overlook the possibility to introduce them to molecular modeling, one of the most powerful tools of modern chemistry?

The discussion in this symposium clearly has ramifications far beyond a single scientific meeting. These opposing viewpoints will continue to be expanded and debated. This symposium represents a early step in what will surely become a more extensive dialogue in the years ahead.

Why Use Presentation Software?

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Over the past several months, Brian Pankuch and I have exchanged several e-mails about the ways to use presentation software, such as PowerPoint, more effectively. Growing out of those conversations, this is the first of what may become a series of short articles, intended to share the results of my own efforts to find better ways to utilize this technology. Of course, it should be read with the usual disclaimers that the opinions expressed are solely my own and that alternative viewpoints will be welcomed.

Despite the rising popularity of presentation software, thus far there has been mixed evidence that it really improves learning. This shouldn't be a surprise. The software was originally developed for sales presentations, and it has been in use a relatively short time for teaching. The main weakness of the product may well be that it is much easier to master the technology itself than it is to discover the pedagogy that will create the best learning environment.

One of the great advantages of presentation software is that it allows an instructor to combine text and images in a single frame. In the past it was all but impossible for a professor to do this without extensive preparation and cost. Psychological research indicates that the juxtaposition of text and images is an effective educational technique, and my students certainly report that the combination of concepts with a related image helps them to remember the material better.

The use of images is particularly valuable for chemists, since a common problem encountered in chemistry teaching is the difficulty students have relating the microscopic world of atoms and molecules to the macroscopic world, which is directly available to the senses. When I ask students what types of pictures are most useful to them, molecular images are invariably the first choice. Molecular images apparently convert an abstract concept into a form that they feel is easier for them to visualize.

The students become deeply involved in the visuals. Events and processes that were formerly difficult to make interesting now come to life, especially the historical references that many faculty love to use. When I talk about poison gas in World War I or the burning of the Hindenburg, I can show the students pictures of the actual events. Students are very responsive to these images. Perhaps the result is best described by quoting what one of my students said on an anonymous survey, "With the computer, the concepts become real. They aren't just notes on a piece of paper. You actually prove that things happen and we just don't have to accept what you tell us."

Whatever the reasons, when presentation software is used well, students report that they very strongly prefer it to other teaching methods, like blackboard or overhead presentations. These favorable results do require, however, that the images be carefully chosen to relate to the concepts being discussed and also that the students be encouraged to make these associations. I have been using a combination of presentation software and cooperative learning for several years and have found that these two techniques are an excellent combination.

What types of images are best? Although the students indicate that all types of images are useful, molecular images are rated highest. Historical images are usually rated lowest, both for interest as well as usefulness. As might be expected, movies create a particularly strong impression. The most difficult part is to select images that are directly related to the concepts being presented. It is a temptation to include "cute" images, especially since most software packages provide a selection of clip art. At best this may represent an opportunity to add some humor to a dry lecture; more often, it is a missed opportunity to clarify and illustrate the text on the frame.

The cardinal rule when using presentation software must be, "Don't rush!" Don't go on to the next frame until the students have had sufficient time to complete their notes. My surveys suggest that many of the students prefer to a rough sketch of the images in their notes. They have recognized that this is a valid learning technique. As teachers, we need to support this behavior, not make it more difficult.

Next installment: Capturing the students eyes.

CALL FOR PAPERS

The Northeast Regional Meeting, June 21-25, 1999, Clarkson University, Potsdam NY. Submit abstracts of papers or posters to: Donald Rosenthal, Department of Chemistry, Clarkson University, Potsdam NY 13699-5810, Phone: 315-268-2352, E-mail: ROSEN@CLVM.CLARKSON.EDU. See the NERM website: http://orthanc.sc.clarkson.edu//~acsnorth/nerm99/ for information about symposia, general paper sessions, workshops, etc.