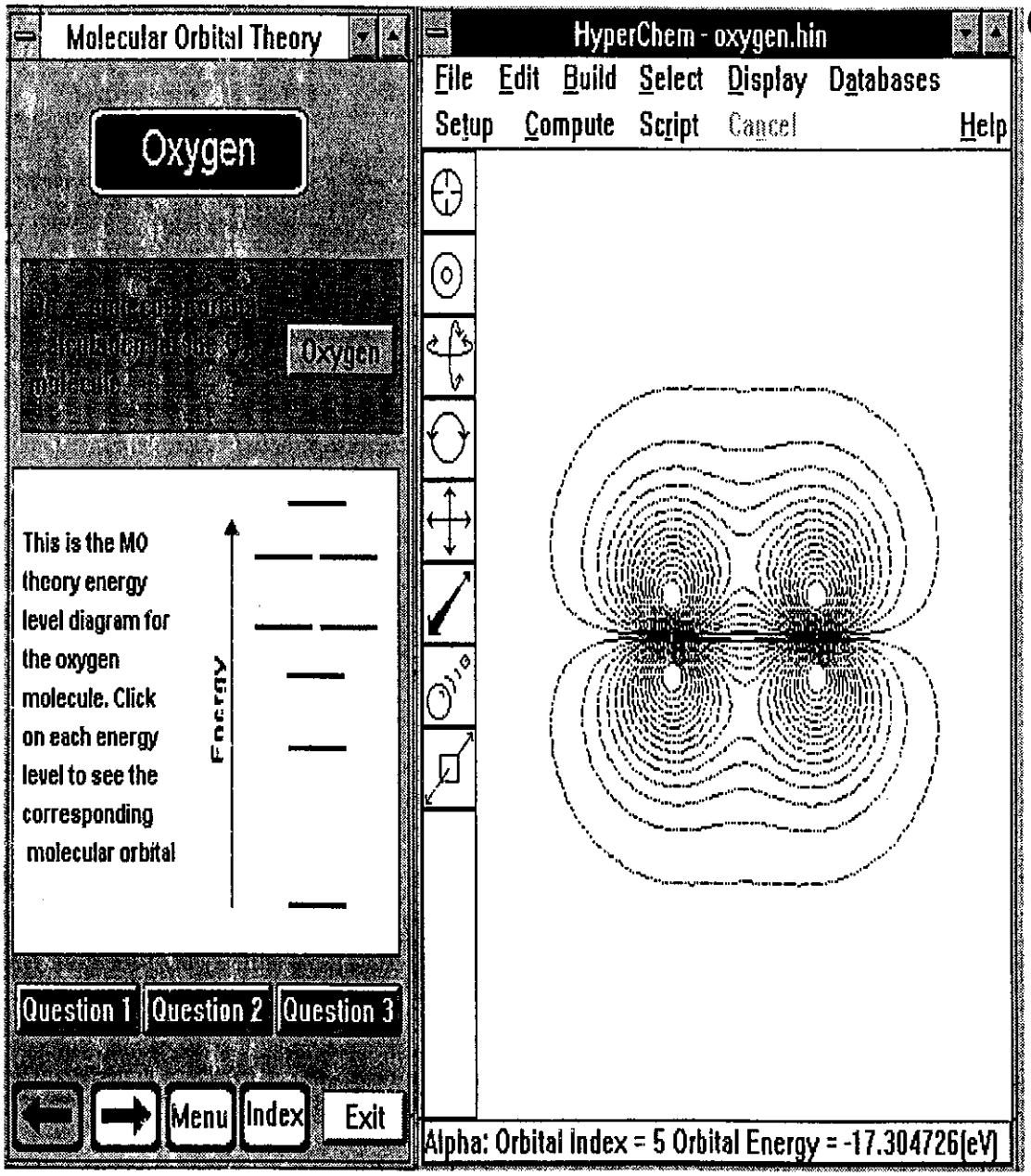
Computers in Chemical Education Newsletter Spring 1997



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Submissions: General articles should be sent to editor Brian Pankuch at the above address. We would appreciate both 1) printed copy (hardcopy) and 2) a readable file on a Macintosh or IBM compatible 3 1/2" diskette. We have fewer problems with 3 1/2 " diskettes. Email submissions are frequently lost, and formatting and special characters are changed.
Submission deadlines: Fall issue - Sept. 25; Spring issue - March 15.

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ALL NEW AND RENEWAL SUBSCRIPTIONS: PLEASE SEND REMITTANCE TO:
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FROM THE CHAIR

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SUMMER 1997 ON-LINE CONFERENCE
June 1 to August 1, 1997

Eleven papers will be presented at the Summer 1997 On-Line Conference featuring "General Papers in Chemistry and Chemical Education". The papers and their authors are:

Paper 1: USING NETSCAPE AS A PRESENTATION MANAGER
Scott E. Van Bramer, Widener University, Chester, PA 19013. svanbram@science.widener.edu, http://science.widener.edu

Paper 2: ASSESSMENT IN CHEMISTRY/NEW STRATEGIES FOR NEW TIMES
I. Dwaine Eubanks, ACS DivCHED Examinations Institute, Clemson University, Clemson SC 29634 eubanki@clemson.edu

Paper 3: WHAT EVERY CHEMIST SHOULD KNOW ABOUT COMPUTERS, II
Mary L. Swift, Department of Biochemistry and Molecular Biology, College Of Medicine, Howard University, Washington DC 20059-0001. mswift@umd5.umd.edu , and
Theresa Julia Zielinski, Chemistry Department, Niagara University, Niagara University, NY 14109. theresaz@localnet.com

Paper 4: THE COSTS OF INCORPORATING INFORMATION TECHNOLOGY IN EDUCATION
Brian M. Tissue, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0212. tissue@vt.edu

Paper 5: USING PSEUDOSCIENCE TO TEACH GENERAL AND ANALYTICAL CHEMISTRY
Michael Epstein, Margaret Bullard, Brad Buehler, Robin Koster, Department of Science, Mount Saint Mary's College, Emmitsburg, MD 21727. epstein@msmary.edu

Paper 6: NATURE DOESN'T SOLVE EQUATIONS, SO WHY SHOULD WE? MATHEMATICALLY-LEAN SIMULATIONS IN CHEMISTRY
Hugh M. Cartwright, Physical and Theoretical Chemistry Laboratory, Oxford University, South Parks Road, Oxford, England OX1 3QZ. hugh@muriel.pcl.ox.ac.uk

Paper 7: SUPPLEMENTAL INSTRUCTION: A MODEL PROGRAM THAT GOES AGAINST THE GRAIN
Cory Emal, Tanya Johnson and Paul Kelter, Department of Chemistry, University of Nebraska, Lincoln, NE 68588-0304. pkelter@unlinfo.unl.edu

Paper 8: THE USE OF EXCEL IN PHYSICAL CHEMISTRY SEMINARS
A. A. Kubasov, V. S. Lyutsarev and K. V. Ermakov, Moscow State University, Russia. kubasov@comp.chem.msu.su

Paper 9: ARE SIMULATIONS JUST A SUBSITUTE FOR REALITY?
Harry E. Pence, Chemistry Department, SUNY Oneonta, Oneonta, NY, 13820. pencehe@oneonta.edu

Paper 10: ENVIRONMENTAL AND INDUSTRIAL CHEMISTRY: AN ON-LINE INTERCOLLEGIATE COURSE
Leonard J. Archer (1), James M. Beard (2), Sylvia R. Esjornson (3), Aline M. Harrison (4), Reed Howald (5), Peter Mahaffy (6), Maria Pacheco (7), Donald Rosenthal (8), Mary M. Schreiner (9), and James N. Stevenson (10).
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(5) Montana State University, Bozeman, MT
(6) The King's University College, Edmonton, Alberta, Canada
(7) SUNY- Buffalo State College, Buffalo, NY
(8) Clarkson University, Potsdam, NY
(9) Niagara University, Niagara University, NY
(10) Concordia University, Austin, TX

Paper 11: CHEMISTRY ON-LINE: A PRACTICAL GUIDE TO THE DEVELOPMENT OF INTERACTIVE, INTERCOLLEGIATE LEARNING EXPERIENCES FOR CHEMISTRY STUDENTS
George R. Long, Department of Chemistry, Indiana University of Pennsylvania, Indiana, PA 15705

grlong@grove.iup.edu

SCHEDULE

June 1 to June 20 - On-Line Session 1

On or before June 1 - Retrieve Papers 1 to 5
June 2 - Short Questions for Paper 1
June 3 - Short Questions for Paper 2
June 4 - Short Questions for Paper 3
June 5 - Short Questions for Paper 4
June 6 - Short Questions for Paper 5

June 9 and 10 - Discussion of Paper 1
June 11 and 12 - Discussion of Paper 2
June 13 and 16 - Discussion of Paper 3
June 17 and 18 - Discussion of Paper 4
June 19 and 20 - Discussion of Paper 5

June 23 to July 11- On-Line Session 2

On or before June 22 - Retrieve Papers 6 to 8
June 23 - Short Questions for Paper 6
June 24 - Short Questions for Paper 7
June 25 - Short Questions for Paper 8

June 30 and July 1 - Discussion of Paper 6
July 7 and July 8 - Discussion of Paper 7
July 9 and July 10- Discussion of Paper 8

July 14 to Aug. 1 - On-Line Session 3

On or before July 13 - Retrieve papers 9 to 11
July 14 - Short Questions for Paper 9
July 15 - Short Questions for Paper 10
July 16 - Short Questions for Paper 11

July 21 and 22 - Discussion of Paper 9
July 23 and 24 - Discussion of Paper 10
July 25 and 28 - Discussion of Paper 11

July 29 to August 1 - General Discussion and Evaluation

ABSTRACTS OF PAPERS

Abstracts for the eleven conference papers are available on the CHEMCONF World Wide Web Site. (The URL is http://www.wam.umd.edu/~toh/ChemConf97.html)

REGISTRATION AND PARTICIPATION

Anyone may register for and participate in this on-line conference. There is no registration fee. To register for CHEMCONF send the message:
SUBSCRIBE CHEMCONF your-first-and-last-name
To: LISTSERV@UMDD.UMD.EDU
Conference information and announcements will be distributed via CHEMCONF.

1997-1998 SCHOOL YEAR ON-LINE SESSIONS

In addition to the summer sessions, there will be school year sessions. The format of the school year sessions is that one week will be devoted to the discussion of each paper. Short questions will be sent on Friday and discussion will occur on Monday through Thursday. The fall semester session will occur between September 5 and November 26, 1997. The spring semester session will occur between January 30 and May 1, 1998. A number of papers have already been promised. Additional authors should contact Thomas O'Haver (to2@umail.umd.edu, 301-405-1831). The deadlines for school year papers are:

June 1, 1997 - Deadline for title and abstract
July 1, 1997 - School year session schedule will be established and distributed
August 1, 1997 - Deadline for receipt of papers for September to December session.
January 1, 1998 - Deadline for receipt of papers for February to May session.

Software Review:
Studio, Director and SoundEdit 16 from Macromedia. (1-800-288-4797).

Brian Pankuch, Editor
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If you are serious about using multimedia to develop content for the World Wide Web or for your courses, and are feeling constrained by Microsoft's PowerPoint, you should consider Director. To really serious multimedia users, I would suggest considering Macromedia's Studio. It includes Director, SoundEdit 16/DeckII, Extreme 3D and Xres. I'll limit myself to Director and SoundEdit since I can't get Xres to work anywhere as well as PhotoShop (both are programs that allow almost magical manipulation of images). The Studio software package comes on four CDs, plus three additional CDs with tools and examples. Studio, which includes Director and three other programs, can be purchased for less than Director costs! Packages are available for both the Mac and Windows operating systems.

Director is a very powerful system which allows you to manipulate and animate anything you can put up on the screen, in color and with sound. I've looked at Director several times but found it rather difficult to use and the results more suited to advertising than teaching. My perspective changed when I had occasion to use Director for a project I did for Sandia National Labs. The project was an attempt to explain very technical material to people who didn't have a technical background. This is pretty close to the situation of teaching many of my students, I decided to pursue experimenting with Director.

In starting with Director 5, I worked through the examples given using atoms and electrons instead of the arty material covered in the examples. I could draw atoms, show electrons, electron clouds, and animate them interacting with each other.

You can put the atoms in a film loop and have them translating, rotating and showing vibration all over the screen. In other words you can make a realistic simulation of how atoms and molecules are thought to act. You can actually see them. You can give the atoms colored patterns, and sound effects while they carom off each other. Perhaps sound and color are like using 11 different fonts and bolding 30 characters per page when word processing just started-a new toy that you play with to see what happens. I haven't tested my work with enough students to see if it makes a difference in their conceptual understanding of interactions on an atomic level. Interest at least is high.

For instance, you can use the same sound everytime an electron is lost by an atom and another sound when the electron is gained by another atom, and still another when a bond is formed. Additionally if color is used consistently so that neutral metal atoms are blue, charged metal atoms red, neutral nonmetal atoms green, charged nonmetal atoms yellow, these visual and sound clues may help understanding. Another plus is that they are also fun to play with which could induce students to spend some time thinking about them and enjoying it.

Figure 1 shows my typical work screen (on a 20 inch monitor), and five of the dozen or so windows you can work in-not counting many special windows. The upper left is the action window where your work or animation appears (called the Stage). Below it is the window where you setup each object-atoms, electrons, molecules (called the Score). This is where you adjust your atoms and electrons to move and interact add sounds and other special effects.

Next, in the lower right we have the storage for your images, film loops, etc. (called the Cast). This is a way of storing objects which may be copied, manipulated and called as often as needed. Objects such as atoms and ions can be created in the Paint window, top right. The Paint window is quite impressive in the versatility and ease of use of its tools.

One way of starting a project would be to make or transfer an image in the Paint window. Use the many tools available (it can also call plug-ins from PhotoShop) to adjust the image to your ideal. The created objects (atoms, electrons, etc.) are simultaneously in the Paint and Cast windows. When ready you can select an object from storage or the Cast and move a copy to the setup or Score window (here the object is called a sprite).

You can combine several drawings the same way simple animations are made-each one is a little different-and make a film loop animation. The film loop for instance might show the stretching vibration of hydrogen in a diatomic molecule. This would be made up of 8 or more drawings of the hydrogen molecule showing the changes during the vibration (or vibration and rotation). You next go through some cumbersome, poorly designed manipulations and have a film loop sprite in the Setup or score window. You can use the command 'in between' to automatically fill in an animation from one point of the screen to another. You can even use the special 'in between' to define curved paths. You would place the film loop in the setup window at the beginning position and another copy at the final position. Then use 'in between' and Director will smoothly fill in everything in between.

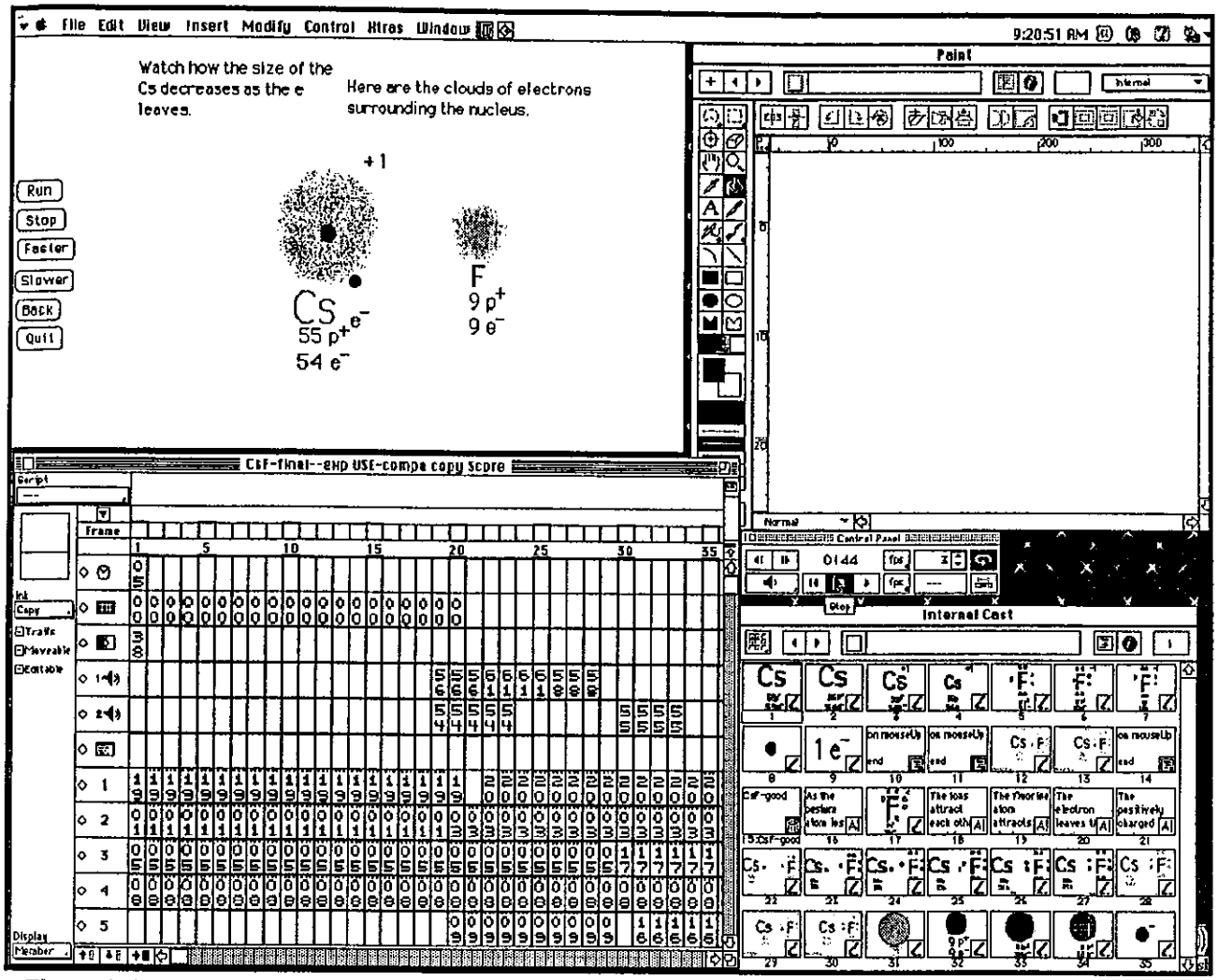

Figure 1 shows a work screen (on a 20 inch monitor), and five of the dozen or so windows you can use. The upper left is the action window where your work or animation appears (called the Stage). Below it is the window where you setup each object-atoms, electrons, molecules (called the Score). This is where you adjust your atoms and electrons to move. In the lower right we have the storage for your images, film loops, etc. (called the Cast). This is a way of storing objects which may be called as often as needed. Objects such as atoms and ions can be created in the Paint window, top right. The Paint window is quite impressive in the versatility and ease of use of its tools.

The result can be any number of atoms, molecules, etc. translating, rotating and vibrating over the screen. These are probably the most powerful commands available in Director.

You can include rotation when you first make your drawings. Show a slight rotation-1/4 of a turn or so- from drawing to drawing as well as the vibration change. The result when you play your movie is one or many hydrogen molecules vibrating and rotating while they zoom around the screen. You can add sound to emphasize when collisions occur. Text can also be made to move so a sentence or two on why individual atoms and electrons don't make sounds, or other matters of interest are easily included. Using chemical fonts (with subscripts and superscripts already built in) is a straight forward way to have subscripts and superscripts wherever you want.

There are other special windows for making text and for making scripts or macros to allow more control. For instance the buttons .(-in the action window top left)-run, stop, back, etc., have scripts attached which give the user control of some aspects of what is happening on the screen. The scripts are written in a special language called Lingo. Lingo even has its own debugger to help in finding errors.

The small window under the paint window is for controlling and following how fast you play your work. Most windows with controls have a built in help similar to Word and Excel. When the cursor passes over the control a

short name appears. For some reason the window I use the most, the Score or setup window, doesn't have this help built in. If you find yourself wishing for an easier way to use a control or tool, try double clicking on it, and often another window will open and make what you're trying to do easier. Not always of course-where is the challenge in that?

Since I'm trying to give you some idea of what Director is like to work with let me mention that what appears to be inconsistencies can cost a lot of time. The action window or stage is where you watch all of your results. For some reason you can't just move or resize it as you can with all the other windows. You have to select 'Modify' from the toolbar, then 'Movie', then 'Properties.' Then you have to fill out a dialog box with no feedback as to what the new window will look like, quit the dialog box, see what you made, then cycle through until you have what you want. Why all this for this particular window? I don't know, but it is a pain. So is the nomenclature (a chemist should talk!?).

Some of the power becomes apparent when you have a movie that calls other movies. I made a simulation of ammonia being formed from nitrogen and hydrogen. The student can see successful and unsuccessful interactions on the screen. Two other movies of catalyzed and uncatalyzed reactions can be viewed at the same time. See Fig. 2. It helps, however to have a big screen! Each movie can be stopped or all can run together or separately. This technique is called a movie in a window. All three show the atoms and molecules moving. I just put these together to see if I could do it. They were made independently.

I find myself constantly asking why I'm showing something a certain way, i.e., can I justify what is happening on the screen? If I can get students in the same questioning mode this will be quite a learning tool.

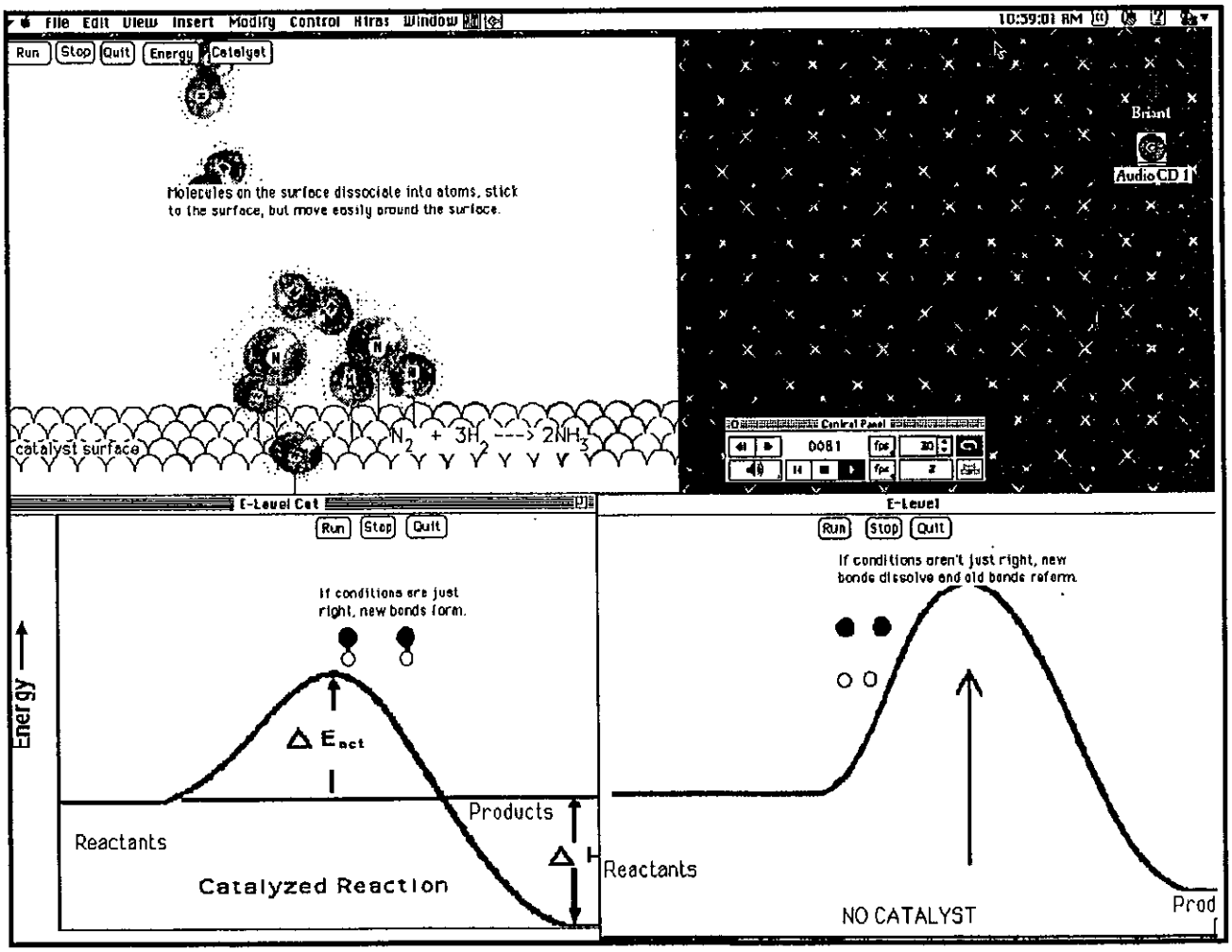

Figure 2 has a simulation of ammonia being formed on a catalyst. by clicking the 'Catalyst' or 'No catalyst' buttons the second movie (lower left of screen0 and the third movie (lower right of the screen) can be launched. Each movie has its own set of independent controls. All three play simultaneously

You can export your work as a movie projector which will run on a computer which does not have Director. The downside is that the included software to make it work is about 1.3 MB, leaving no room for your work on a diskette. My smallest projectors are about 1.7 MB. So you probably need a removable disk drive such as Iomega, Epson, or Syquest to move your work, or a lot of patience working with the Internet. A second method is to make a Quicktime movie. This results in a smaller file but buttons for users will no longer work. It also requires a lot of memory for Director.

I can give Director about 15 MB on my system and it needs more to make a QT movie. According to Macromedia's technical support using Ram Doubler doesn't help. I tried it and it didn't. The Quicktime movie is generally an advantage since you can resize it to fit any screen. You also have a great deal of control over how it plays.

The movie projector can be played on both the Mac and the PC, but to do this you need buy Director for both systems. This is expensive.

SoundEdit 16 is a really clever program. Figure 3 shows a graph of the sound, with a portion selected. You can cut and crop, and paste. You can choose from 8 bit or 16 bit sound and use compression techniques which will decrease the file size by up to a factor of 8. There are 19 modifications or special effects you can make. Once you compress your sound you lose the ability to do most of the modifications, so make the modifications first then compress.

The program comes with a variety of sounds. You can also record then modify your own. You can record the sounds, if you wish, directly onto the Mac. Figure 4 shows the graph of me speaking the last sentence. The program seems much more intuitive to me than Director. I'm not doing very complicated operations like having a synchronized soundtrack for a whole movie, but it does seem to have a great deal of power to make changes easily.

You can put special effects such as: Backwards, Echo, Emphasize, etc., on a toolbar for easy use. Many aspects of the program are customizable, this is helpful if you use the program a lot. You can copy part of the sound you see and just play that portion. Figure 4 shows both the sound as a linear waveform and as a spectrum which maps the relative strengths of the frequencies in

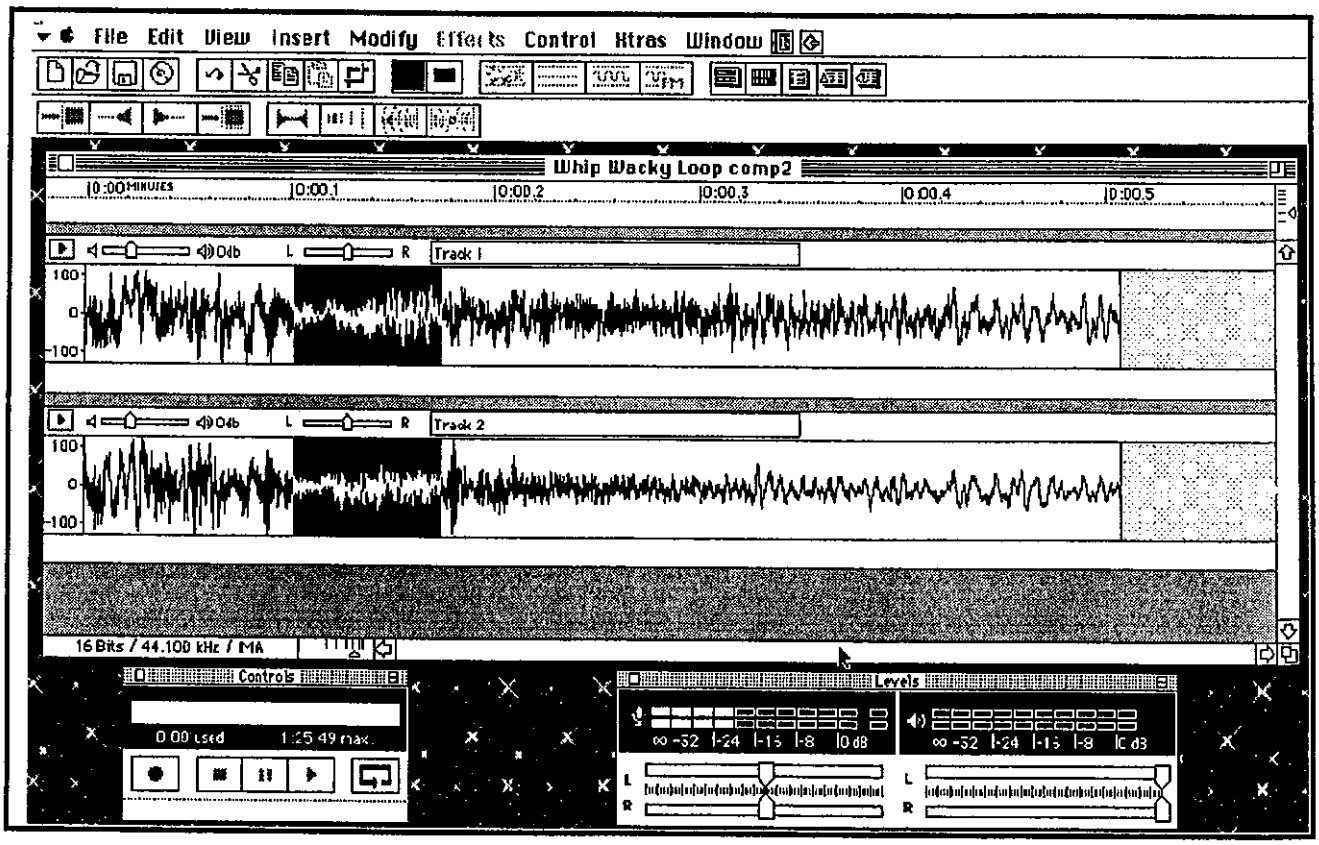

Figure 3 is a graph of one of the sounds used in a Director movie with part of it selected. The selected portion can be cut and cropped, and pasted.

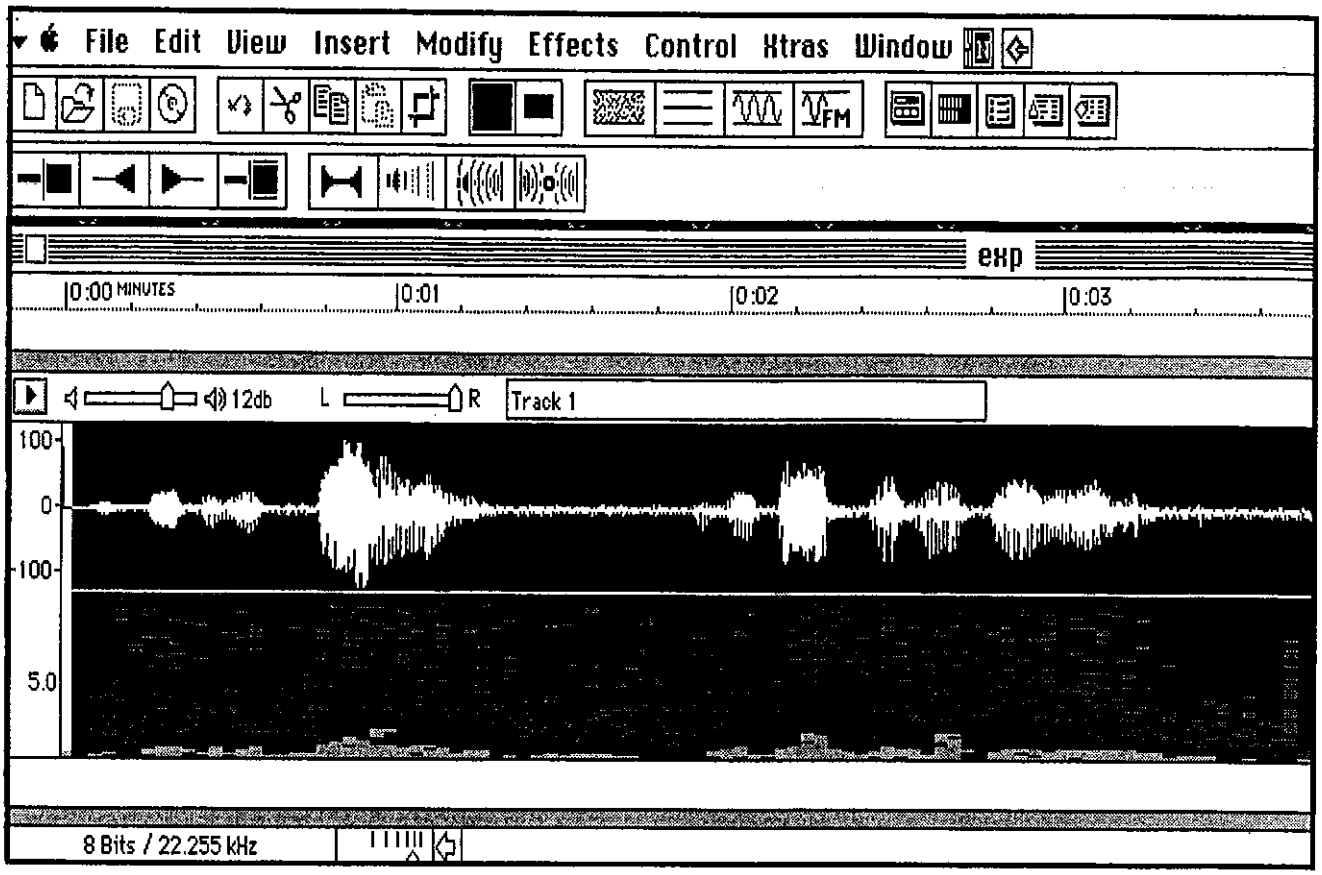

Figure 4 shows the graph of me speaking a sentence. It shows sound as a linear waveform and as a spectrum (lower portion) which maps the relative strengths of the frequencies in the sound.

the sound. You see more detail in color. You can show the spectrum simultaneously as 2 D (frequency and time) and 3 D (frequency, time and power). There are a wide variety of options to emphasize different aspects of a graph. The ability to cut and paste on the graph of your sound, and listen to the change immediately, makes working with SoundEdit delightfully easy.

You can add a lecture or comments to go with the action on the screen. The easiest way to do this is just to speak and record as you watch the movie on the screen. The sound track takes very large amounts of memory. I have some question as the value of having a roomful of computers lecturing and making special effects sounds.

If the SoundEdit and Director programs get easier to use and less expensive it will be interesting to see students' ideas of what is happening at the atomic level.

Will a more 'realistic ' picture of interactions at the atomic and subatomic scale have any long term value? I like to think so. The closer to reality the better the chance for a real insight? Or will students get less practice in using mathematical models because this is so much easier? There has been some interesting results published (Zeweil at CalTech) about femtosec(10-15) reactions using lasers to excite and study energy changes and physical movement in reactions. Perhaps by making it easier to form a model through animation the next step of understanding femtosec reactions will become easier. And with that understanding may come better control of simple and complicated reactions. What do you think?

A ToolBook Front-End for a Molecular Modeling Program

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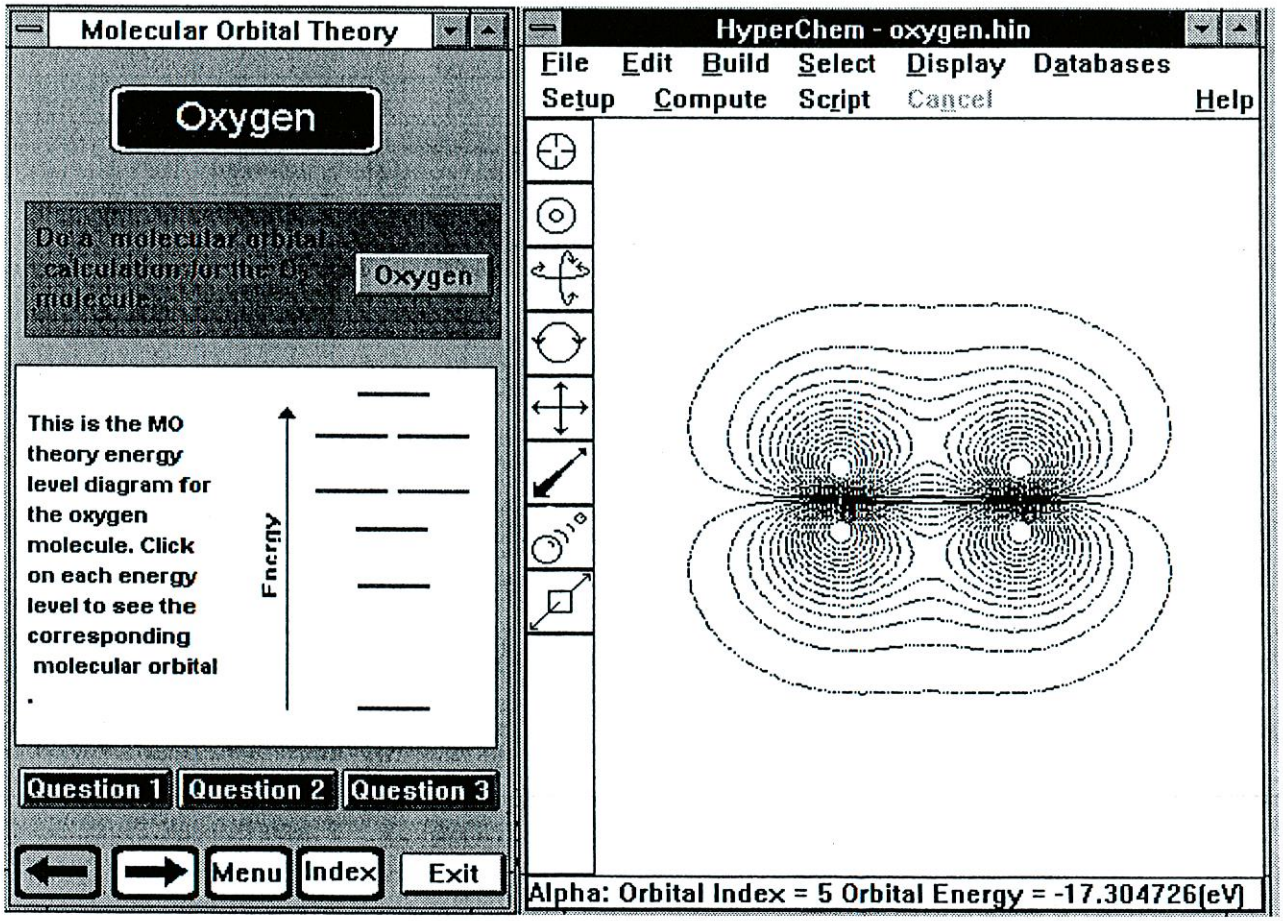
Five years ago we purchased three copies of the molecular modeling software package, HyperChem, for our General Chemistry and Physical Chemistry courses. HyperChem is running on three 486 PCs in one of our laboratories. As part of a five-week laboratory-based project on organic chemistry and spectroscopy, the General Chemistry students in my sections sign up in pairs to use the computers. In one assignment, the students use molecular mechanics to model organic molecules as part of an introduction to organic chemistry. In another they do semi-empirical molecular orbital calculations as part of an exercise teaching about molecular orbital theory.

This hands-on approach with HyperChem seemed to be a good way to teach these concepts and to introduce our students to molecular modeling. It was not without difficulties, however. One problem was upper-level students, who were using HyperChem for other purposes, leaving it in a nonstandard configuration that sometimes confused the introductory students. We also found that the General Chemistry students spent one to two hours learning how to use the program, which was undesirable since our main goal was to help the students learn about organic chemistry, spectroscopy, and MO theory -- not how to use the program.

HyperChem is a Windows 3.1 program that can be linked to other Windows applications, such as ToolBook and Excel. We have written several previous applications with ToolBook 1.5, and decided to use it to develop a front-end program that controls HyperChem. The ToolBook and HyperChem programs run in two windows displayed simultaneously on the screen. The students can transfer control to either program by clicking on that program's window with the mouse. This has the advantage of always starting HyperChem in the same configuration. It also decreases the learning time significantly, because the only HyperChem tools that



the students must use are the rotation tools that rotate the molecule and the selection tool with which they can see the calculated bond lengths and bond angles. All other HyperChem operations, such as building the molecule, setting up calculations, doing the calculations, and observing the molecular orbitals are controlled by buttons in the ToolBook program.

We have written two ToolBook front-end programs -- one for molecular mechanics and the other for molecular orbital theory. The MO program is constructed as a series of pages that lead students through a Molecular Orbital Theory lesson. One page in this lesson covers the oxygen molecule. In this page, clicking on the Oxygen button in the ToolBook window prompts the construction of the oxygen molecule in the HyperChem window, followed by an AM1 calculation. The students can rotate the molecule using the HyperChem rotation tool or select the bond to observe the calculated bond length. They also can click on an energy level in a molecular orbital energy level diagram shown in the ToolBook window and see the contour of the corresponding HyperChem MO.

An additional advantage of using a ToolBook front-end program is the ability to include buttons that pop up "question windows" on the screen. For instance, three questions are included on the Oxygen page. The first question asks the students to sketch the eight valence electron MOs of oxygen and identify them as or and bonding or antibonding (a ToolBook reference page, which introduces these labels, is included in the program). The students next are asked to feed the oxygen electrons into the energy levels and to predict if molecular oxygen would have unpaired electrons. They then predict whether the molecule would be diamagnetic or paramagnetic, and observe a video of liquid oxygen in a magnetic field. The ability to ask questions such as these and to supply reference information in the same program that controls the molecular modeling software turns the ToolBook program into more than just a simple front-end. It also is being used as a teaching tool.

We have found that the ToolBook-HyperChem combination has several advantages. It has furnished us with an efficient way to introduce molecular modeling in conjunction with our laboratory program. It also has given us the opportunity to use molecular modeling to teach about organic chemistry and molecular orbital theory. The present ToolBook program is not totally satisfactory, however, because of one remaining problem that we have not been able to solve. The ToolBook program is set up so that it loads first as a window that occupies around 40% of the screen. After the ToolBook front-end has loaded, it automatically runs Hyperchem. Unfortunately, we have not found a way to get the HyperChem window to fill the other 60% of the screen. Because of this we must load the programs in at the beginning of the day, or when the programs have been shut down during the day, in order to manually bring the HyperChem window to the proper shape and size. This has not prevented us from using the program, but has been an annoyance that we would like to eliminate. We are in the process of pursuing a solution to this problem.

Acknowledgments

The author would like to acknowledge NSF Grant USE-9151873 that partially supported the purchase of computers and software for this project. He also would like to thank Loretta Jones of the University of Northern Colorado for discussions during the development of the front-end program.

Multimedia - Are we all speaking the same language?

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It's 11pm once again! For the last 4 weeks no one gets to leave before midnight. The programmer has been glued to the computer to the point that he can't see straight and my assistant and I have been burning (writing) CD-ROMs and testing them furiously mimicking all the varied things that students may do to the product once it's in their hands. Once again it's product deadline time. Sound glamorous? Well, it really is not, but it is the reality of larger scale multimedia productions. For the last 18 months, this large scale CD-ROM project has come in and out of my life, and if I'm lucky it will be done within the next six months. This is what happens when you have virtually no budget and a staff that until recently is mostly volunteers. On the upside, I have learned a tremendous amount (directly propor-

tional to the number of hairs I've lost from my head) and my current co-workers are becoming professionals! So I hear that you are interested in multimedia, I am all for it but make sure you think about it seriously before diving in, it will save you a lot of time in the end. I have been thinking non-stop about multimedia in education for the last 3 years and I hope I can shed some light on the process.

But before even thinking about making multimedia, what is multimedia? This term has been overused in the last few years to where it is used to describe almost anything that is on a computer. If we look at its traditional definition, it really just means that more than one type of media is used, e.g., pictures plus sound. Just think, lectures are multimedia if you write on a board and talk all in the same presentation! So how do we describe multimedia since the word is really not specific at all? I have been struggling with defining different educational media materials because in working with tens of different instructors, I find that a common vocabulary is a real challenge but necessary to understand what instructional media can do. I will apologize in advance that the samples I mention in this article are biased towards what I have been personally involved with or have had contact with the author - there are many wonderful pieces of instructional multimedia I have never seen.

Now to the task at hand, what vocabulary do I use when thinking about, and describing multimedia? To start, I ask myself several questions about various aspects of the media in order to describe it, including: 1) How is the information structured? 2) How does the user interact with the information? 3) What type of media is it? 4) How is it distributed to the user? I will expand on these questions below.

1) Structure of the media (information flow) can be classified as:

Singular - The media has only one screen or general interface. An example is a program such as the Rasmol molecular viewer or the emission applet on the web found at http://mc2.cchem.berkeley.edu/Java/emission/emission.html. In singular flow, the user can usually alter variables and manipulate data.

Linear - The media flows linearly through its content. A prime example is a movie or Powerpoint presentation.

Branched - The media elements flow through various branches that may, or may not have, interconnections. Examples include textbooks on CD-ROM

2) User interaction with the media can be thought of as:

Presentation mode

Passive - the user has little control over the flow of information other than stop, go, rewind, fast forward. This is the interaction found in a Powerpoint presentation or in a movie.

Active - the user has a choice over which paths to follow through the information. This type of interaction is found on the World Wide Web where there are millions of linear paths the user can navigate.

Interactive mode

Static - the user's choices, or question responses, have little or no effect on the flow or continuation of the piece.

Dynamic - the users' choices, or responses to questions, alter the behavior of the piece beyond just informing you of a right or wrong answer.

Synchronous - the user's actions, words, or images are communicated in a synchronized manner to instrumentation, various different locations, or to other individuals or groups. Examples of this include controlling machinery remotely and videoconferencing.

Asynchronous - the user's actions, words, or images, movies, etc. are communicated to others in an asynchronous fashion. E-mail and newsgroups are two examples of this type of interaction.

3) Type of media

Animation - A series of cartoons, drawings, or models that are played in a fairly linear fashion.

Video Movie - A video that is played back on a VCR.

Digital Movie - A movie that is stored in a digital fashion and viewed on a computer. The computer allows the user to resize, play in forward and reverse directions, alter speed, and step forward or backwards frame by frame.

Simulation - The user can alter variables and affect what happens on the screen. Things like the passage of time, size, scale, shape, color, behavior of objects, can all be changed and the effects observed.

Visualization tools - The user can view information and manipulate it to see different representations of given data. Molecular viewers are a prime example of this.

Databases - Repositories of information that can be used to gather information to complete a task. A prime example is the MoleculesR Us site sponsored by the NIH where the user can search for the coordinates of

any large bio-molecule - http://molbio.info.nih.gov/cgi-bin/pdb.

Explorations - Content provided to the user without a great deal of structure for the purpose of letting them explore and gather information to answer a given question. Examples of this include Web pages with a series of links for students to wander through to answer specific questions. More complex uses include pictures, movies, simulations, and animations.

Immersive environments - The user is immersed in a context and affects the outcome of what happens to him or her. Usually there is a story element that lends an element of reality. Examples of this type of media include our AirbagsRUs virtual company or the Wiley Liftoff module.

4) Ways of distributing the media

Internet - The material is made available on the Internet and is accessible via FTP or Web browsers like Netscape. The limitations with this approach include: the necessity of an Internet connection, slow transmission rates, and limitations to what web browsers allow.

Floppy disc/s - The old standard - almost everyone has the capability to read one. Main drawback - cannot hold more than about 1.4 Mb of material.

Removable discs - Removable discs such as Zip or Jaz discs hold 100-1,000 Mb of material - plenty but few people have them.

CD-ROM - The new (sort of) standard for delivering up to 600Mb of material. Relatively inexpensive but rather slow when looking at complex media pieces.

I hope that by mentioning how I think about media I have stimulated thoughts in you the reader. Be aware that any given multimedia piece can contain various media types. There are numerous other crucial issues that I think of when thinking about media including: 1) Educational value and effectiveness, 2) People, time and costs associated with producing the media, and 3) Strengths and weaknesses of the media. All of these issues are extremely important when you are creating educational media - I will not say more about them here but I will write more about them in the future with references to the latest literature.

As I return to burning more CD-ROMs, I just want to mention that the ways I think about media are in no manner exhaustive and this is really my first stab at putting all of this down on paper. I would welcome and appreciate any comments directed at molinaro@cchem.berkeley.edu. I find media fascinating and a wonderful tool to teach chemistry. I am certain that the next few years will bring us wonderful media that will enhance our students' understanding of chemistry, as well as our (at least my) own.

JCE Software: Changes for Changing Times

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If you read the Journal of Chemical Education, you probably know that anorganization called JCE Software publishes computer programs, videodiscs, videotapes, and CD-ROMs for chemistry education. You may not have noticed that JCE Software is actually the Journal of Chemical Education Software and is a publication of the Journal of Chemical Education, owned and operated by the Division of Chemical Education, Inc. of the American Chemical Society. As such, JCE Software is an academic publication with the same high standards of peer review as the Journal. Before I became a Technical Editor for JCE Software in 1994, I did not know much more about it than that, except for a little experience with some of the publications. Since then, I have learned a great deal more-this is a unique way of publishing software, combining rigorous review with a non-profit attitude and a desire to get the materials into the hands of as many educators as possible. Our goals are to provide the academic recognition due authors of electronic media for use in chemistry education and to make these materials available at prices any school or teacher can afford. I feel privileged to be a part of this vital organization. I'd like to tell you a little about some of the changes that have been going on in JCE Software over the past year.

JCE Software has since its beginnings been called the electronic publishing arm of the Journal of Chemical Education, but for the most part it functioned as a separate entity. That changed tremendously in September 1996 when John W. Moore, JCE Software's founding editor, assumed editorship of the Journal of Chemical Education. There are many obvious changes in the move of the Journal's editorial offices from Austin, TX to Madison, WI, home of JCE Software. In the spring of 1996 the JCE Software staff moved into "Journal House" a renovated house owned by the University of Wisconsin-Madison and located about a block away from the chemistry building. As the new members of the Journal staff were hired, they moved into Journal House. Now the Journal of Chemical Education and JCE Soft-

ware really do function as a team. Submissions are received in a central office and directed to the most appropriate publication media: print, disk (or CD, video, etc.), or Internet (Word Wide Web). John Moore's dedication to the promotion of new technology in chemistry education is well known in the chemistry education community. It is very exciting to be a "computer person" under his editorship of the Journal.

The JCE Software staff has undergone some major reorganization. The role of editing JCE Software now belongs to Jon L. Holmes, formerly the JCE Software Senior Technical Editor. He is not only responsible for JCE Software, but for all the electronic publications of the Journal, including the newly developed JCE Online and JCE Internet. More responsibility for JCE Software now rests with me. In addition to my former duties, I now do all the page-layout and desktop-publishing of the printed documentation. I have a greater responsibility for all aspects of materials published on disk or as video. The transition has required a great deal of adjustment from everyone involved. It has also given us an opportunity to examine some of our procedures and in many cases to streamline them. I am pleased with the results so far, and I hope that both our authors and subscribers agree. More changes are ahead with the redesign of software documentation currently underway, and the growing submissions of Web-based materials.

JCE Software has some new and different publications that you may have seen abstracted in the Journal. Here are brief descriptions of three that we are particularly excited about:

Journal of Chemical Education on CD-ROM (JCE: CD 1996) was announced in January of this year. As the name implies, this is the full text of the Journal of Chemical Education on CD, for Macintosh and Windows computers. It includes all the text and graphics of the September-December 1996 issues of the Journal-including the complete 1996 Index. All text is fully searchable for author's name, titles, words, and phrases. Production of this CD has truly been a joint venture of the Print and Software staffs. This CD is a prototype for future CD's that will contain a full year of the Journal. Users are asked to complete a survey about the CD. We will use the results to make future issues of JCE: CD the best possible resource for chemistry educators.

The JCE Software General Chemistry Collection for Students, (Special Issue 16) marks two firsts for JCE Software. It is the first time that all of our most popular general chemistry software for PC-Compatible, Macintosh, and Windows computers has been available in a single package, and it is our first publication to be sold specifically to students. We are working on an instructor's version of the CD for publication later this year. As a larger and larger fraction of students own their own personal computers, we believe that direct access to JCE Software publications recommended or assigned by their instructors will prove very beneficial to learning. We are very excited about the possibilities.

Periodic Table Live! (Special Issue 17) combines three JCE Software issues, the Periodic Table CD (Special Issue 10), Chemistry Navigator (Volume 6C, No. 2), and Illustrated Periodic Table (Volume 2D, No. 2) in one integrated, easy to use CD-ROM. These are three of JCE Software's most popular publications and we believe that this issue will quickly become a best seller. An abstract for this issue will appear in the April issue of the Journal. With publication of this issue, JCE Software for the first time in its history will have all of its periodic table materials "off the drawing board" and in distribution. Will Periodic Table Live! be the ultimate periodic table package? We can't wait for our users to let us know!

What is next for JCE Software? With "Big Changes" like new offices, and new editors and "small changes" like the removal of the colon from our name (formerly JCE: Software), we are moving toward the future, ready to adapt to meet the needs of the chemistry education community in times of changing technology. In the next year you can count on seeing some great chemistry video on CD-ROM and more instructional software from chemistry educators, but we will not know exactly what is coming next until you tell us.

Upcoming publications depend entirely on submissions from dedicated chemistry instructors (like those who read this newsletter!) who devote their time and energy to the development of innovative new media for use in their own classes, and then decide to share it with the rest of us by submitting it to the Journal of Chemical Education: Print, JCE Software, or JCE Internet. With all of us contributing, there are no limits to the possibilities!

There are also new ways to get in touch with JCE Software. Point your WWW browser to http://jchemed.chem.wisc.edu/, send an email message to jcesoft@chem.wisc.edu, call toll free in the USA (800) 991-5534, or from anywhere in the world dial (608) 262-5153, or send a FAX to (608) 265-8094. And the old way still works too-send a letter to JCE Software, University of Wisconsin-Madison, Department of Chemistry, 1101 University Avenue, Madison, WI 53706. Authors interested in submitting any new media for chemistry education for publication in JCE Software can contact me directly at gettys@chem.wisc.edu or JCE Software, 209 North Brooks Street, Madison, WI 53715.

INFORMATION AND EVALUATION FROM INSTRUCTORS OF THE SPRING 1996 SEMESTER ON-LINE COURSE "ENVIRONMENTAL AND INDUSTRIAL CHEMISTRY"

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I. INTRODUCTION

Previous articles have described the on-line course (1), presented information and student evaluation summaries (2) and provided some evaluation from James Beard (chair of the course organizing committee) (3). In this article information obtained from a course information and evaluation form filled out and returned by sixteen of the course instructors will be summarized.

II. COURSE DESCRIPTIONS

Each instructor was asked about the course as taught at his/her school. Since similar information was obtained from the students and has already been reported (1,2) and detailed descriptions are available about courses taught at nine of the participating schools (4), no summary will be provided here.

III. STUDENT PAPERS

More detailed information about student papers is described elsewhere (1 to 4). The comments below are from instructors and are generally quoted in unedited form.

(1) I was not aware of any problems during the submission of our students' paper. For this reason, I ASSUMED that the paper had been successfully submitted, and I did not request any confirmation from George Long. (N.B. - George Long was in charge of the course website.) Since he did not receive our students' paper, he did not confirm receipt of it and I continued to be ignorant of our problems. I have mixed emotions about our failure to submit the paper. . . . I'm not sure that our students knew much more about the topic than they had already found and written into the paper. Furthermore, problems encountered by my students while sending e-mail would have been multiplied if they had tried to respond to many questions from participating students in other colleges. Basically, we have a two-tiered e-mail system, one for faculty and staff, in which older bugs with "bitnet" addresses have been removed, and one for students, in which there are continuing problems. This realization may have been the major finding by our students and faculty during this course!!

(2) Need to have much better planning for the student paper preparation in the next offering of this course. Rules, possible topics, and exact requirements should be handled ahead of registration and should be listed specifically on the course home page, Faculty should be encouraged to make the student paper assignment as a definite requirement for this course!

(6) From the pre-course information, we thought group papers submitted to the website were not optional. We were disappointed that every participating school did not post a paper. I suggest better cooperation from participating schools, more requirements and a common syllabus.

(8) I suggest there should have been two deadlines - One deadline for early papers from which the two student papers to be read and discussed by all course participants are selected (This deadline was established.) - A second deadline for additional student papers.

(9) The students learned a LOT about writing papers with others when writing that one paper together!!! They learned a lot about the writing styles of others and the need for organization and being thorough with their portion of the responsibility.

(10) The major problem that we encountered is that our semester started relatively late. This gave us little time for an introduction to environmental chemistry. Very early in the course the students had to select topics and begin working on their papers. The first month of the course was a lot of work for everyone. I know that it was not possible, but it would have been much better for us if our semester had started at least two weeks earlier. We had three weeks of the semester

remaining after the end of the on-line segment.

(17) I was not aware of the source of the student papers and had prepared my syllabus without mention of them. The question of student papers seems to be a major source of misunderstanding, now as well as during the course. I am satisfied with the way it was handled. It seems that some may think that it is unfair that some students had to and other students did not have to write papers. If student papers continue to be part of other courses of this type, please keep them optional. Allow free participation by all those who are interested. Course requirements should be determined at each local school.

IV. DISTRIBUTION OF PAPERS VIA THE WORLD WIDE WEB

Course instructors were asked whether the format of papers as they appeared on the WWW was satisfactory.
93 % satisfactory
7 % unsatisfactory

Specific comments:

(9) Preferred HTML format so papers could be read on-line (N.B. some student papers were available on the WWW in RTF or text format and not HTML format).

(11) I appreciated having access to preliminary copies of some of the expert papers available weeks in advance.

(12) In the future, I hope a CGI-BIN form could be added to allow comments to be posted on the web page, and viewed by subsequent readers.

(13) It would have been good to standardize format. Perhaps all HTML.

(17) One of the papers could have been better edited to appear more unified and less disjointed.

V. OLCC-STU DISCUSSION LIST

This Listserv was designed to provide interaction between authors and students, and between students.

Instructor evaluation of OLCC-STU
88 % Satisfacory
6 % Unsatisfactory
6 % Abstained

Course instructors read or skimmed the discussion.
The average percentage of discussion saved or printed by the course instructors was 60 %. (S.D of mean = 12 %). 35 % saved or printed all of the discussion. 18 % saved or printed 0 to 4 % of the discussion. The discussion was archived on the website and the OLCC-STU discussion list. Some instructors sorted the discussion and archived them in separate folders or mailboxes by paper. (I printed each of the messages and sorted them by paper and topic. None of the course instructors seem to have done this.)

Most of the course instructors read all of the discussion.

Some specific comments:

(1) I believe we made an error in designing OLCC-STU when we decided to have papers from "experts". I wish we had referred to them as "authors", "moderators", "discussion leaders" or "resources", so that students would have felt more equal to them when writing their questions. Many students thanked our experts for sharing their time with us. Unfortunately, we never convinced the students that the experts were really approachable. Some students definitely had the feeling that they had one chance to petition the expert for information. This feeling encouraged, if not caused, a one-way flow of information, instead of a broader discussion which I would have preferred. In particular, there were very few conversations among students to obtain information. Even the answers to questions about the student papers seemed to be a one-way flow of information.
How do you encourage students to have more confidence and to take more initiative and responsibility for their own education? I believe you have to take the fear away from the students and encourage them individually. For this reason, our class met weekly. There were lively discussions about environmental and industrial chemistry. We were not completely successful, as evidenced by the few questions posted by our best students. We would like to try again and I would sign on to a similar course in the future.

(2) Insist on accurate and definitive subject lines for each message!!! Continue the procedure of NOT allowing faculty to post to the OLCC-STU Listserv. This should be

preserved as the student domain!

(4) I wasted a good deal of time pairing questions with answers. In those postings which were answers to specific earlier postings, I would have asked that the earlier question be included in the response in its entirety - though possibly broken up sentence by sentence to clarify which question was being addressed - and that the response keep a fragment of the question header including time and author. This is not too different from what was, in fact, done. I would have preferred to be able to count on it since it would have saved me a lot of time. This could lead to a string of comments being transmitted - and being available together.

(5) It would be useful if someone (a moderator) could format the titles to some standard form so sorting and reading could be done more intelligently.

(6) Getting used to a high volume of mail, and maintaining multiple threads of discussion are challenges to novice e-mailers.

(9) Use a bulletin board or notes format in the future with a bulletin board or note number for each paper. . . need to separate subjects - - have authors post discussion questions - don't stratify the timing so tightly.

(12) I think it would be a big advantage to use eudora or something similar. The students had more problems than I did since they typically can't use eudora and are given only a small amount of disk space.

(13) Quality of discussion was very mixed. The best response was generated to the student papers.

(17) I know that some were overwhelmed with the number of messages arriving. I feel that the lesson in organization and information management was an important aspect of the course. Consistent adherence to the instructions concerning use of subject lines would have been a big help. "Question for Dr. Trehy" as a subject line does not say a lot to many people and it turns out to be useless when one looks through the index in order to find something.

VI. OLCC-FAC DISCUSSION LIST

This Listserv was designed to provide interaction between course instructors, expert authors of the papers and the organizing committee. Instructors had an opportunity to ask questions, to make suggestions and to discuss various aspects of the course.

Instructor evaluation of OLCC-FAC
82 % satisfactory and useful
18 % abstained

Most read and saved messages.

The average percentage of discussion saved or printed by the course instructors was 65 %. (S.D of mean = 8.5 %). The percent saved or printed varied from 4 to 100. 25 % of the instructors saved or printed all of the discussion.

Specific comments:

(2) I knew exactly what to expect by monitoring the OLCC-FAC Listserv. Any local instructor had equal opportunity to ask and participate in the OLCC-FAC discussion for smooth course operation.

(4) There was far more use of it in the semester before the course was offered. I gather we were all busy with other work while the course was being offered. There wasn't time for discussion!

(17) I soon realized it was not necessary to respond to all messages. I did try to respond promptly to some messages.

VII. ON-LINE QUESTIONS AND DISCUSSION

88 % Found the scheduling of questions and discussion to be satisfactory
12 % Found the scheduling to be unsatisfactory

Some specific comments:

(2) It was difficult for some schools to work around the various spring breaks (but this is unavoidable).
I would like to see a larger portion of the full semester used for the on-line portion (start earlier and finish later). This would likely hurt schools on the quarter system. Perhaps if more offerings occur, separate discussions might be designed for the semester and quarter courses.

(4) Perhaps the question and discussion periods could be shortened a bit.
It was different from what I'd expected, but my sense is that it is quite similar to what happens when a seminar speaker comes as long as
(a) there are more than a few minutes available for questions, and
(b) faculty stay out of the discussion.

(8) Some more focussed suggestions for starting off discussions.

(11) More time for questions would help in some cases. We did not get the level or amount of student discussion I anticipated.
(12) Looking back, I would make the discussion period longer, and try to move away from a rigid question and answer session.
(14) Especially towards the end, it got confusing. Some way of keeping the questions and answers to separate papers separate would have been very nice.
(15) More time is needed for questions and discussion.
(17) With three weeks before the start and two weeks at the end (at my school) it would seem that some of that time could have been used to extend the discussion time, but if I were to do it again, knowing what I do now, I would want to use that time to help the students get organized and to get in the mood (correct attitude) for working on-line.

VIII. SOME EVALUATIONS

Evaluation scale 1 to 5 -
1 is Poor, 3 is Average and 5 is Excellent

(a) Overall evaluation of on-line papers
Average evaluation = 4.08, S.D. ave. = 0.11, n = 17

Comments:

(2) Expert papers need to be "hotlinked and interactive" as were the student papers.
(6) Student papers were written for a student audience; expert papers were edited professional papers, not intended for a student audience . . . many things left unexplained, and the quality of the student response showed that.
(9) Papers did not offer areas for discussion. Rather they were a description of processes and systems about which students knew little. In the future, similar papers with a series of questions, discussion areas of interaction or politics could stimulate more discussion.
(10) The major difficulty I had as an instructor was to put the papers in context -- to provide background. Most of the references in the expert papers were inaccessible to us.
(12) All the papers were good, but the lengths were inconsistent.

(b) Overall evaluation of OLCC-STU questions, answers and discussion
Average evaluation = 3.64, S.D. ave. = 0.20, n = 14
(The average evaluation by the course students was 3.86)

Comments:
(2) I would like to see more technical questions posted by the students that would produce more actual discussion of chemistry in the answers and subsequent discussion. This began to occur toward the end of the on-line session.
(4) Our students reported being quickly overwhelmed by the volume of discussion. Because the faculty couldn't know what to anticipate, it was difficult to focus our local discussions. After a seminar, if there is a question which we do not understand or which doesn't interest us, we tend to ignore it and turn our listening strength back up to high when the next question starts. We aren't experienced in doing that with text.
(6) It got better with time.
(9) Students asked questions largely because that was how the course was structured. Most of the students were juniors and seniors. We functioned pretty well that way. In the future, how about beginning with one expert paper as a model, then student papers with expert (supportive) comments extending areas for discussion . . . to promote student work and discussion.
(10) Many questions were fairly simplistic and required answers that the students could have found by themselves. Other questions were trivial. I expected more interactions between students.
(11) Ranged from trivial to well thought out. Expert answers 4. Some answers were too shallow, and some bias was evident. Student answers 5
(12) There were redundancies, and some trivial questions - though the majority were very good
(13) Mixed in quality. Some screening at each institution might have helped.
(14) I was hoping for more discussion between the students but there was very little of that. I guess I shouldn't be surprised since discussions in class are even hard to get started.
(15) A mix of very good, very bad and in-between questions (as expected)
(16) Excellent! I was surprised and delighted with the general sophistication of the student comments and questions.

(17) While some of the questions were very good, others probably should not have been asked. If I were to do it over, in the classroom I would challenge them as a group to evaluate each others' questions before posing them on-line.

(c) Overall evaluation of OLCC-FAC
Average evaluation = 4.06, S.D. ave = 0.17, n = 16

Comments:

(2) This is only as good as the participation of the ones using it. It could have been more useful, but each of us was extremely busy with this experiment which was probably in addition to our normal duties.
(4) The experience we received from this communication was helpful. The authors of the expert papers were very responsive to questions. The format allowed us to offer a course on this subject to only two students, and "bring in" real expertise.
(6) Often helpful and useful . . . I expected there would be more traffic than there was . . . were we a bunch of lurkers?
(10) I would have preferred more discussion between faculty on how they were conducting the course at their location. However, I certainly didn't provide much information.
(11) More use by individual teachers would have helped us all.
(12) I had hoped for more discussion of what the students were thinking about. With a few exceptions discussion was mostly technical.
(13) Useful for networking of instructors
(14) Good information and exchange of information
(15) There should have been more instructor participation.
(16) I thought it all went better than we had any reason to expect. It was after all an experiment. I think it was a huge success.
(17) I am strongly in favor of more faculty interaction on any level. I seek it out on my campus and would have liked to see more more of it on OLCC-FAC, but I think that available time did not permit greater involvement by faculty.

(d) Best paper
14 % of course instructors rated Paper 1 best
14 % rated Paper 2 best
36 % rated Paper 3 best
25 % rated Paper 4 best
11 % rated Paper 5 best

The average evaluation of the best paper was 4.35, S.D. average = 0.17, n = 13

Comments:

(1) The author was careful to introduce many topics related to environmental and industrial chemistry.
(2) It contained the most technical chemistry content and probably induced students to learn more actual chemistry than the other papers.
(3) This paper presented more issues that the students could discuss and debate. Since the issues were not black and white, the students had to consider more of the complexities of the real world.
(4) We did not work with all the papers.
(6) The students from Niagara did a fantastic job . . . well researched, well written. They were knowledgable. Responses were every bit as good . . . writing to and for other students . . . I was completely impressed with their efforts.
(9) Lent itself best to discussion
(10) This had more technical information on actual chemistry.
(12) The student papers were at a better level for the students and took more advantage of the World Wide Web.
(13) The two student papers did the best job of engendering discussion. The quality of the expert papers was excellent.
(15) Well written - very interesting
(17) It was well written with a lot of first-hand information (obtained from their tour). I would have liked to see a "purpose" for the paper and an analysis by the authors of the situation with conclusions.

(e) Best discussion
27 % of the course instructors rated the discussion of Paper 1 best
20 % Paper 2 discussion best
0 % Paper 3 discussion best
10 % Paper 4 discussion best
43 % Paper 5 discussion best

The average rating for the best discussion was 4.38
S.D. ave. = 0.14, n = 13

Comments:

(1) Questions were wide-ranging and thoughtful.
(2) This paper created the most questions, answers and discussion. Students responded very rapidly, providing an opportunity for follow-up discussion. It was the most comprehensive of all the papers.
(3) See (d) above
(5) Probably because everyone was fresher and ready to start. Also, this paper needed a lot of clarification to help the group see the underlying chemistry.
(6) We got the "hang" of it . . . lots to comment on.
(8) the most "chemical"
(9) had the most ethical and political ramifications
(10) This paper was more general and required less knowledge to pose good questions. The subject matter was more controversial.
(12) More comments for this paper. I think this is because the students were more familiar with the medium.
(15) Maybe because it was the first paper, there was considerable motivation.
(17) I feel that he was excellent and to the point in answering questions. He seemed very relaxed.

IX. WHAT LIKED BEST ABOUT THE ON-LINE COURSE

(1) The opportunity to participate!
(2) It was a demonstration of the teaching effectiveness of the Internet for national distance learning coursework. It introduced our students to a communication medium that they will be using in many ways for the rest of their careers. It demonstrated a national collaborative effort among teachers and students in Chemistry.
(3) The opportunity for the students to consider various sides of the issues. Through the discussion they were able to give and take.
(4) The dedicated involvement of industrial chemists, and students at other schools, which gives our students an additional window.
(5) The wider discussion group than is possible on a small college campus.
(6) the diversity of backgrounds of the participants, and the wealth of viewpoints, comments and questions
(7) the variety of students enrolled
(8) the exposure of my students to policy issues linked to science
(9) brought new information that would have been difficult for me to collect alone
(10) a- The opportunity to have our students interact with industrial chemists
b- The requirement that the students use e-mail and the World Wide WEb
(11) The timely thoughtful answers from student authors - This clearly showed other students what is possible.
(12) My students were very excited about the course - that made it fun to teach
(13) the availability of experts - the way students worked with each other across national and international boundaries
(14) the way the students got interested in the topics and in the Internet
(15) Ability of students to access material not covered in a traditional course - ability of students to interact with the authors and other students - flexibility of the work
(16) Brought together students and faculty from diverse academic institutions
(17) The opportunity for a wider range of interaction for the students as they learn from other - both authors and readers

X. WHAT LIKED LEAST ABOUT THE COURSE

(1) Our local failure to enable and encourage students to send e-mail.
(2) I felt like a slave to my computer terminal for about one hour each day this semester. We need to make this virtual classroom more personal in some way. I miss the student to faculty one-on-one interaction that occurs in the regular classroom.
(3) The students viewed the authors with too much sense of authority.
(4) Coming in on Monday to find over forty e-mail messages
(5) The large volume of e-mail found in my box every morning
(6) That there was no background provided for the "expert" papers. None of my students had any industrial experience. . . A primer paper on how chemical industry works is a must if I do this course again.
(8) I wish the balance had been a bit more toward chemistry. The course seemed roughly at the sophomore level and I would have advertised it that way had I known far enough in advance.
(9) the message system and no time to apply a foundation for discussion
(10) the huge amount of e-mail generated
(11) An overwhelming load in OLCC-STU at times in February - many of the messages were trivial

(12) The information glut
(13) The mixed quality of the discussion
(14) Trying to keep track of the questions and answers
(15) Huge number of messages, my students suggested maybe having a smaller number of institutions or students participating or having another way to "pace" the messages - they were overwhelmed by all the messages and questions they received - sometimes not enough time to digest all the information
(16) The time it took - For me, it was effectively a very small overload.
(17) The short time for discussion on-line

XI. ADVANTAGES OF ON-LINE COURSES

(1) Wide-ranging topics, and more freedom to relate to students.
(2) Instructor expertise can be applied on a variety of topics for the smaller college curriculum.
(3) It allows the mixing of ideas and learning over a more diverse student population. It also allows us to marshall resources which might not be available to individual institutions.
(4) See my answer to IX above
(5) A pooling of talents and expertise not available otherwise
(6) flexibility of hours, ease of communication
(7) easy access to experts at little expense
(8) broadening of our departmental offerings without addition of faculty; ease of monitoring student discussion
(9) multiplicity of expertise
(10) See my answer to IX above
(11) discussion and cooperation between students on different campuses - up to date material presented by both experts and by students
(12) There are many - the access to experts and information is very powerful - the students ability to research a particular issue and then respond to the list immediately also is an important advantage
(14) exposure to information that we do not have at our school
(15) See my answer to IX above
(16) Expands the meaning of an academic course
(17) wider involvement of the students and the opportunity to communicate with authors directly and in "real time"

XII. DISADVANTAGES OF ON-LINE COURSES

(1) Technical difficulties and fears about using e-mail
(2) The actual workload for this course seemed to be much higher than I expected. Perhaps this only comes with the first offering of such a course.
(3) The students often had trouble dealing with the large amount of diverse incoming e-mail.
(4) Not appropriate for groups as large as the one this semester. It takes a LOT of organizational work, which is not easily done because the faculty never met face to face. The paper-discussion format seems inappropriate unless students are beyond the introductory level.
(5) Little face-to-face discussion - I lose the ability to evaluate the presenters and their personalities.
(6) Managing high volumes of mail (but not a major problem).
(8) less control of what happens (in a course run by this many institutions); harder to change flow of course if instructor wishes to
(9) spend time opening messages rather than communicating
(10) The necessity of designing the course to be applicable to a diverse student and institution population
(11) growing pains - variety of requirements between different campuses
(12) Students were overwhelmed with information at first. They also would occasionally lag. Then they were lost.
(14) too much mail some days

(15) See my answer to X
(16) The additional time it takes
(17) We had several challenges with hardware breakdowns - so that would be the disadvantage in my mind. One student used his own computer exclusively and missed a portion of the course when his hard drive crashed. In the future, I would require them all to have accounts on the school system.

XIII. CHANGES WHICH MIGHT HAVE IMPROVED THIS COURSE

(1) Get rid of the "experts" and designate them as "authors" instead
(2) Preregistration would help plan for the total number to be handled (you will probably need to restrict registration next time to between 75 - 100 students) and allow those pre-enrolled to start paper preparation to obtain better student papers. Consider different offerings for those schools on the quarter and those on the semester systems.

See if expert papers could be created that were more "interactive".

(4) Limit the amount of communication from any one student on any one paper or set of papers, in the way that faculty moderating discussion in a classroom would delay recognizing those who had spoken previously. We had expected that our two students might work with others on preparation of a joint paper. That possibility (a) is important to those students enrolling at sites with few other course students, (b) needs more support from the organizing committee, if just to better describe it to faculty.

(6) Better cooperation between participating schools

(8) copies of the papers well in advance of the start of the course (our students registered in November — it would have been nice to be able to give them a better idea of the emphasis of the course)

(9) use a bulletin board and notes - use more student generated papers and experts facilitating and promoting discussion

(10) Have all the papers linked to web site references or use readily available hard copy sources.

(11) We are clearly now in a position to suggest things to try differently the next time or for a larger experiment. I do not think that less or more planning would have been better - we hit very close to an optimum.

(13) Some screening of responses - Otherwise I think it was very successful.

(14) organize the mail better

(15) Smaller groups participating - fewer papers to be studied and/or make the class longer - consider the fall semester to avoid conflicts with different spring breaks

(17) Locally, I would make changes in the requirements of class meetings locally and include the possibility of student papers.

XIV. ADDITION COMMENTS OR SUGGESTIONS

(2) Should a formal proposal be submitted to ACS to fund this course on a continuing basis?

(8) We used an outside expert of our own (a recently retired industrial chemist with an interest in environmental chemistry) to be a resource for the students and to help read and grade their final papers — this was an enormous relief for the faculty member in charge (i.e. me)

(10) The utilization of web based references in Paper 5 was extremely helpful.
I would like to thank the Organizing Committee and others who worked on this course. My students and I learned a great deal. It was worth the time and effort.

(11) We need one or more follow-up attempts. The electronic record of this trial should be kept available on the www.

(17) One of the great challenges we face is the great quantity of information on the Internet presented without review of any kind. In a course such as this I would emphasize the need to critically review information presented in an open forum such as the Internet. The students must be taught to realize that defense and peer review are important parts of scientific information presentation. If they think that just because it is on the Internet, it is authoritative, they need to correct their thinking!

XV. AMOUNT OF WORK REQUIRED OF EACH STUDENT

82 % of the course instructors believed the amount of work was About Right
18 % Too Little
(Student responses to this question - 83 % about right, 17 % excessive)

Comments:

(2) About right for my students whose paper was selected for on-line discussion. The student on-line defense of their own paper was a very productive portion of the course at our school. It would be good if all students could benefit from some type of experience such as this. Perhaps a "paper exchange" could take place between "non posted" schools in which they could ask questions of each other in private messages off-line.

(10) The reading and discussion of five on-line papers and the writing of one paper did not come close to making sufficient work for a three hour course. I should have made it a two hour course, but I thought it better to overestimate. Since this is not a required course and our majors don't have any electives, all the students took this as an extra course on top of their regular courses. This lowered the priority.

(14) Too little, but that was partly my fault for not requiring more off-line work.

(17) I originally planned for much greater student involvement in the discussion than they ever achieved. Perhaps all of the two weeks for each paper could be designated for

on-line discussion with the second of the two weeks as the time for the author to respond to questions. I imagine that getting a commitment for two complete weeks from the "experts" would be difficult.

XVI. AMOUNT OF WORK REQUIRED OF THE INSTRUCTOR

79 % About right
3 % Too little
18 % Excessive

Some comments:

(2) It seemed excessive for this first offering. My students' paper was selected which required additional effort. I would do it again, just plan more time to be spent. It was probably not as much effort for those who did not submit papers, or did not have student papers on-line. This inequity needs to be addressed so that all local courses will share in the total effort put forth in this course. The intercollegiate competitive nature of this course must be maintained and encouraged. Student papers should be made a firm requirement. Many chemists will be hesitant to make their students WRITE! But it should be encouraged, because the writing component of this course is one of its strongest attributes.
(4) The work wasn't really excessive (except for the organizing committee), but it was more than I had anticipated and, because it put me at the maximum load faculty are allowed to have, more than I could easily handle. It was a load I hadn't previously learned to handle efficiently. It was a load that I couldn't easily move to different days and times.
(5) This course was in addition to my normal load. So it became excessive for me. If it was part of my normal teaching load, it would have been about right.
(6) I had a very enjoyable course.
(8) Once it got rolling, nothing much required. At the beginning, a bit of an overload.
(10) Like the students, I undertook this course in addition to my regular course load (Organic I and II, three labs, half of our non-science major course and two research students). As a result, I was unable to provide as much additional material and homework as I had wished. If this had not been an uncompensated overload, the amount of work would have been about right.
(13) This course was done as an overload on my part to make it available to students.
(16) About right, but in my particular case it was an overload.

XVII. INTERESTED IN PARTICIPATING IN A FUTURE ON-LINE COURSE

88 % Yes
12 % Maybe

(4) Yes, if the topic would supplement what we can offer our students

XVIII. INTERESTED IN HELPING TO PLAN A FUTURE
ON-LINE COURSE

56 % Yes
19 % Maybe
25 % No

Comments:

(5) Yes, depending on the topic
(17) Yes. Since we have no chemistry major, I would like to see the topic "Environmental and Industrial Chemistry" is one I would like to see repeated, perhaps with different authors and/or papers, since it fits so well into the Environmental Science major that we do have.

XIX. REFERENCES

(1) Computers in Chemical Education Newsletter Spring 1996, p. 17 to 20
(2) Computers in Chemical Education Newsletter Fall 1996, p. 9 to 18
(3) Computers in Chemical Education Newsletter Fall 1996, p. 21 to 22
(4) http://www.clarkson.edu/~rosen2/olcc.html

FROM THE CHAIR

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A. ROLE OF THE COMMITTEE

The CCCE seeks to publicize and promote the use of computers in chemical education.

B. MEMBERS OF THE COMMITTEE - 1997

Charles Abrams - McGill University, Montreal, Canada
James Beard - Catawba College, Salisbury, N
James W. Beatty - Ripon College, Ripon, WI
Joseph Casanova - California State University, Los Angeles, CA
Wilmon B. Chipman - Bridgewater State College, Bridgewater, MA
Nancy S. Gettys - University of Wisconsin, Madison, WI
William Halpern - University of Western Florida, Pensacola, FL
Carolyn Sweeney Judd - Houston Community College, Houston, TX
Alfred Lata - University of Kansas, Lawrence, KS
Yuzhuo Li - Clarkson University, Potsdam, NY
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Marco Molinaro - University of California, Berkeley, CA
Thomas C. O'Haver - University of Maryland, College Park, MD
Brian Pankuch - Union County College, Cranford,NJ
Harry E. Pence - SUNY College, Oneonta, NY
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Gwen Sibert - Roanoke Valley Governor's School, Roanoke, VA
Stanley Smith - University of Illinois, Urbana, IL
Carl H. Snyder - University of Miami, Coral Gables, FL
Brian Tissue - VPI and State University, Blacksburg, VA
David M. Whisnant - Wofford College, Spartanburg, SC
Theresa J. Zielinski - Niagara University, Niagara University, NY

C. ON-LINE MEETINGS AND SYMPOSIA

An on-line Conference entitled "General Papers in Chemistry and Chemical Education" will be held during the summer of 1997 and the 1997-1998 school year. See the article elsewhere in this Newsletter for additional details.

Anyone interested in organizing a three to five week (5 paper) session at a future (1998 and beyond) on-line meeting should contact me (ROSEN@CLVM.CLARKSON.EDU). I would also like to hear from anyone interested in managing a meeting Listserv or Website.

D. ON-LINE INTERCOLLEGIATE COURSES

The CCCE sponsored and helped organize an intercollegiate course entitled "Environmental and Industrial Chemistry". This course will be described and discussed in this year's summer on-line conference (Paper 10). In addition, George Long will present a paper (Paper 11) entitled "Chemistry On-Line: A Practical Guide To The Development Of Interactive, Intercollegiate Learning Experiences For Chemistry Students".

I would be interested in hearing from those who are willing to help organize an on-line course.

E. NATIONAL COMPUTER WORKSHOPS

Three day National Computer Workshops were held last summer before the BCCE at Clemson University. There were a total of 68 registrants for these workshops. It seems likely that similar Workshops will be held before the 1998 BCCE at the University of Waterloo. More information about these Workshops will be included in the Fall 1997 issue of this Newsletter.

F. CCE NEWSLETTER

The publication of this Newsletter represents a major activity of the Committee on Computers in Chemical Education. Articles submitted for publication are printed in a timely manner. Anyone interested in submitting an article should contact Brian Pankuch, Editor of the CCE Newsletter (PANKUCH@HAWK.UCC.EDU) or me.

G. OPEN MEETING AT BCCE MEETINGS

In recent years, the CCCE has held open meetings at the Biennial Meetings. These are well attended and provide an opportunity for interaction between Committee members and those attending. A meeting was held at Clemson and another meeting is planned for the 1998 BCCE at the University of Waterloo.

H. WE ALWAYS NEED IDEAS AND SUGGESTIONS

The success of the Committee depends upon our interaction with you and other chemical educators. Please send us your ideas and suggestions.

11. Are you a member of the:

ACS?	____ Yes	____ No
Division of Chemical Education?	____ Yes	____ No
Division of Computers in Chemistry?	____ Yes	____ No

12. Areas of Computer Activity and Interest:
Leave the space provided below blank, if you have no present interest or activity. Insert a number from 1 to 4 depending on the amount of activity.
1 means with a consuming passion, 2 means considerable
3 means moderate, and 4 means a little.

	Activity	Interest	Description of Use
Word Processing	____	____	_____
Spreadsheets	____	____	_____
Data Bases	____	____	_____
Other Languages	____	____	_____
Simulation	____	____	_____
Numerical and Statistical Methods	____	____	_____
Graphics	____	____	_____
Interfacing	____	____	_____
Laboratory Automation	____	____	_____
Drill and Practice	____	____	_____
Other (specify)	____	____	_____

13. Provide a brief description of the hardware you use.

_____

14. Other Comments or Suggestions:

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