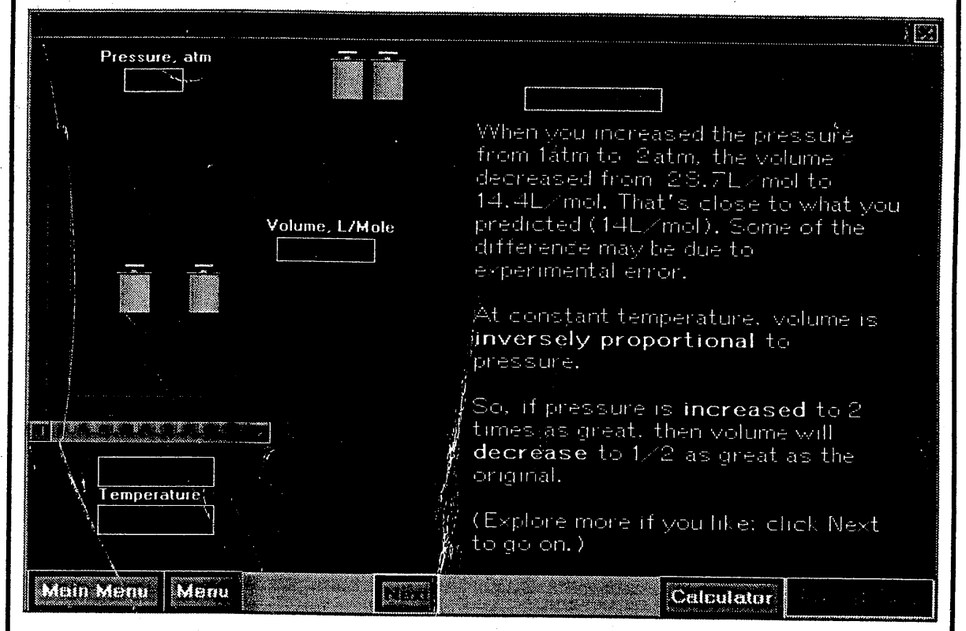
Computers in Chemical Education Newsletter
Spring 1999



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Committee On Computers in Chemical Education
Harry E. Pence Chair

Editor Brian Pankuch, Department of Chemistry, Union County College, Cranford, NJ 07016 pankuch@eclipse.net, or pankuch@hawk.ucc.edu..

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. If attachments are used please send a description of what your using-such as Microsoft Word 6 with Netscape 4, separately. This gives me a chance to decode it.

Submission deadlines: Fall issue - Sept. 25; Spring issue - March 15.

ALL NEW AND RENEWAL SUBSCRIPTIONS: PLEASE SEND REMITTANCE TO:
Donald Rosenthal, CCE NEWSLETTER, Department of Chemistry, Clarkson University, Potsdam, NY 13699-5810.
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CONTENTS

Message from the Chair

WHERE'S THE REVOLUTION?

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Several years ago, I gave a presentation entitled, "A Report from the Barricades of the Multimedia Revolution." At the close of my remarks, someone in the audience objected that the term revolution was inappropriate, since technology would not cause enough change in the way that we teach to justify this description. He predicted that in a decade we would still be teaching the same things in chemistry classes, with the only change being the possible addition of a few technological bells and whistles. If I remember correctly, I replied that we would have to wait to see if I were right or not.

I was reminded of this conversation during the on-line CONFCHEM sessions early this year, especially the one concerned with what we teach in general chemistry. For me the significance was not just the challenge to the status quo, but the fact that 800 chemical educators from all over the world were involved in the discussion. In the past, a proposal of this type could attract the attention of a relatively small number of college teachers for a very short time at a conference or in a journal. I was impressed with how much technology is changing the way we communicate. This role of technology as a facilitator of change may be far more important than any specific new teaching technologies introduced into our classrooms.

This impression was further heightened a short time later when I read an article entitled, "The Future That is Already Here" by Philip Clark in the April 1999 issue of The Technology Source (http://horizon.unc.edu/TS/vision/1999-04.asp). Without electronic communications, it is unlikely that I ever would have seen this article, and it even possible that it would not have been written. Clark argues that, to a large extent, we can now identify the factors that will shape the future of higher education and the rough shape of that new world is already visible. One of the most important of these factors is surely computer-facilitated communications, and as noted earlier, we are already beginning to see the effects of this. Clark argues that the future of higher education is already in place and we should focus on trying to harness the driving forces behind this change.

The coming decade may present a special challenge for all of us in higher education and especially for the Committee on Computers in Chemical Education. Whether it will truly be revolutionary remains to be seen, but it will certainly involve many challenges to our normal way of doing things. This Committee will increasingly be called upon to provide the technology needed to facilitate changes in both how we teach as well as what we teach. Our most important task is to remember that technology must always be the servant of pedagogy. As long as the main goal is to improve the educational process for our students, we are on solid ground, whether we call it a revolution or not.

Multimedia in Lecture
Continued

Brian Pankuch, Editor
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I've just finished my first semester using PowerPoint in lecture. Here are some observations while they are still fresh. You can spend a great deal of time putting together your own PowerPoint lecture material. Add to this a less than clear idea of what you can use under copyright law in your lecture, on an intranet, or the Internet, and I'd suggest asking the author(s) of the textbooks you are using if they have material available.

Jack Kotz, 'Chemistry and Chemical Reactivity', is making his PowerPoint material available at http://www.saunderscollege.com/chem/general/masterton/ for users of his textbook. You need User ID and a password available from a Saunders representative.

Karen Timberlake, author of 'Chemistry', Harper Collins, has some of her PowerPoint lectures available at: http://www.lavc.cc.ca.us/dept/chemistry/timberlake/

index.html

Just as we don't use textbooks verbatim I'm sure you will want to make changes even in excellent work such as these, and it will give you a really useful start. You'll want to customize it for your situation. A number of people suggested using a dark background, such as deep blue, with yellow-gold fonts. I experimented with some PowerPoint backgrounds, designs, and color schemes. Between those included with PowerPoint and the PowerPoint value pack there is a wide variety of choice.

You can strip out anything you don't like. Bring up one of the designs in PowerPoint and play with the entire screen, I stripped out the background shapes and put in some of my favorite molecular structures made in a drawing program. The structures are faint and don't seem to affect readability, a number of students commented positively on it. Once you get a design you are happy with go to View-> Slide-> Master and save your creation to be the default for your slides.

I used both a dark blue and a dark green for background. Jack Kolz uses lighter backgrounds and his looked great projected. He also tends to use a lot of graphics and at least 32-36 font, colored boxes, and shadow effects. There are many ways to set up the title with text and graphics. Having a title box and a textbox on the master worked well with the font size and color set. It is quite easy to add additional textboxes and graphics, buttons, links to movies, programs, or the Internet.

Other admonitions are to use at least a 28 font, Arial seems to project very well with my system, but any plain font seems all right. You can use a lot 'animations' in PowerPoint. These are ways to have your text move onto the screen, some with sound. Many experienced users suggest not mixing too many fonts, 'animations,' and sound effects. Personally I like 'appear' and 'zoom in' with an occasional 'fly from the left' for special emphasis.' Looking over slides I have used this last semester the ones that appeal most visually are those with a 32 font and graphics. Another suggestion is not to put up too much text. This is easier said than followed in practice since there are advantages to having a complete concept or problem available on one slide.

Graphics: A picture is still worth a lot of words, and is often a good take off point for discussion. Having the graphics supplied with the PowerPoint lecture material from a publisher without concern for copyright is helpful. JCE: Software has a number of CD's with graphic material including QuickTime movies available at http://jchemed.chem.wisc.edu/, for use as additional material. Let us know if you find other sources.

I ran a simple questionnaire past my students about a month into the semester to get feedback about PowerPoint while I could still use it, and found that they generally like the PowerPoint format quite a bit. A few felt we were going too fast. Most of the remarks made to me in person about going too fast were from students who never made it to class on time, and then took another lengthy period to get their material out and start taking notes.

With a remote in one hand and a laser pointer in the other I find myself walking more among the students, and in particular spending more time near students who are doing poorly. It is interesting, many are just doodling, and gentle suggestions that it may be a good idea to copy down some of the material resulted in better performance. Some of my A students took virtually no notes, but were generally attentive and interactive.

In place of a screen the lectures were projected on the side wall. This allows me to have a large Periodic Table at the front and room to put up additional material on the board in response to student questions. A number of students commented they got more out of the problems done at the board than those laboriously done in PowerPoint. Since those done at the board were in response to specific student questions it is not surprising.

As mentioned last time I projected some examples where students answered multiple choice questions or parts of questions by holding up cards with a-d on them. This continual feedback on how the entire class is doing was helpful. It also keeps the daydreamers more involved.

I used a number of QuickTime movies and Director animations, http://www.eclipse.net/~pankuch/use_animation.html (which I made myself). There are 2 ways I can call up QuickTime movies. One is to make a link from the slide by selecting a button or graphic on a slide, and command-k (on a Mac) then choosing the address of the movie. Clicking on this link allows you to open the movie in Simpletext where the movie plays fine, except you can't resize the movie or anything else. OK for me since I have software that allows me to enlarge the movie to my hearts content. Though this is a little tedious. An alternative is to link to MoviePlayer, which usually plays the QuickTime movies. In MoviePlayer you can resize the movies directly, loop endlessly, etc., but you have to use File in MoviePlayer to open your movie.

I decided I didn't want to be fumbling between many different electronic systems to show QuickTime movies

and Director animations, simulations and programs. I wanted it as smooth as possible-click and connect. This means having everything I use on my PowerBook hard drive. At the moment my PowerPoint files are about 400 MEG and growing. I can access anything with a few clicks. Drives 8-9 G are available with 36 G shortly available, and of course DVD is also available so you can have a lot of storage.

Showing a 30-60 second QuickTime movie once is not effective with my students. What seemed to work was putting a simulation up on loop letting students watch and discuss it with their study group. I asked the students to write up the important points they saw individually, collected them, and read a few anonymously, discussing with the class what was being missed. I then summarized the important points. I didn't announce it, but put up the same simulation for the next test. Students were asked for an explanation as an extra credit problem - virtually everyone did quite well.

This would cost a great deal of time to do with each QuickTime movie, perhaps doing it occasionally will develop some critical ability that carries over.

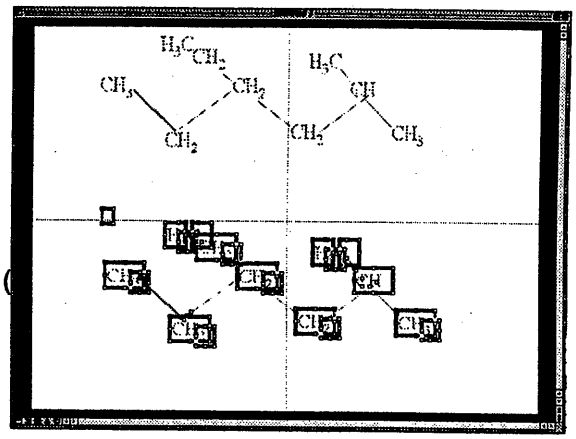
My decision has been to use my big desktop machine at home for all development work. Primarily because I have a 20" screen and the mouse is much faster than the touch pad at the moment. Only "finished" work is then transferred to the PowerBook. Unfortunately some links seem to be lost doing this unless I do a complete transfer of the whole 400M file. Clicking on links and having then fail in the middle of a lecture is not fun. A cable can be used to hook the PowerBook directly to the desktop computer it then acts like another hard drive and transfer of the entire 400M file is a couple of minutes.

When comparing different strategies I use, students at the end of the semester had the most positive remarks about having them solve problems at the board with their study groups (I also use the study groups on research projects). They were positive about PowerPoint, and linked animations. When asked for suggestions of what to tell students starting the course my interactive chemistry programs were at the top of the list.

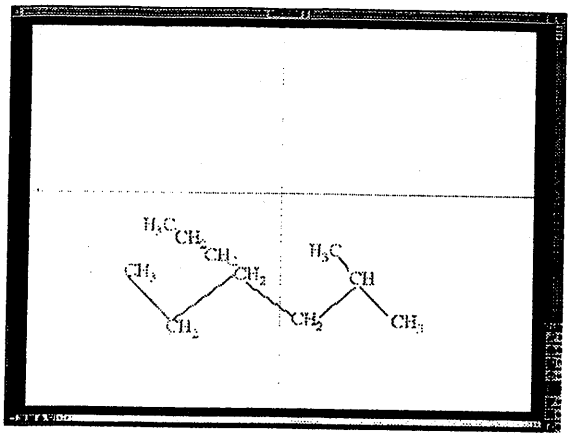
Tests that had been given previously were used for comparison. No meaningful differences were obvious looking at grade distributions.
I did, however, have one lecture in which no one earned less than a C, which has not happened for over a decade. I'll be impressed if this happens often. For the moment it is a lot of time and energy, but bouncing out of bed early on Saturday and Sunday to enthusiastically try a new idea is great. Personally I'd recommend it highly if you enjoy playing on computers and exercising some creativity, but I'd start with as much already done as possible from your publisher, and spend your extra energy on being creative for your individual students. Enjoy!

Adjusting molecular structures in PowerPoint:

If you take a structure built in a drawing program such as ChemIntosh 3.4.4 the structure may be somewhat different than you want. Or you may want to make a few changes in it without leaving PowerPoint. A handy way to make changes in PowerPoint is to take the structure, select it then choose ungroup



At the top of the figure is the molecular structure. The bottom of the figure is what it looks like after it has been selected and ungrouped. I have the icons for group and ungroup on my toolbar. For those with contextual menus (on a Mac) you can select any portion of the drawing holding control and a popup menu will give you access to group and ungroup.



I've taken the original structure, ungrouped it, selected and duplicated a CH_2, pasted it in so I've added a CH_2, and thickened the bonds in the backbone.

In the above figure the new structure has been selected (use your mouse to draw a selection rectangle around the entire molecule) and regroup clicked on. The resulting structure may be moved, stretched, shrunk etc. You can ungroup move, delete, copy and paste parts and group together as often as needed.

Personally I find this easier if I don't have the drawing program up and running.

Brian Pankuch, Editor
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Possible change:
We've been discussing switching from a printed Newsletter to only electronic on the Web. If you have any ideas pro or con send comments to me at pankuch@eclipse.net.

Using Multimedia II - Setting the Stage

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The topics of room design, equipment selection, and teacher training are too complex for a short presentation of this type, and fortunately administrators are normally willing to dedicate serious resources to these decisions. Unfortunately, there are some other basic requirements that are not very glamorous but are equally essential to support a computer -based lecture. These often-overlooked topics include well -designed lighting, good technical support, and an assurance that the teaching space will continue to be available from semester to semester. The absence of any of these can create a potential disaster, despite a well planned facility.

Considering how much money is being spent on equipment for multimedia teaching, it is amazing how often I encounter rooms where the lighting is inadequate. In one case, I visited a campus to give a talk and was assured that the lighting in the room where I was going to speak was adjustable. It was; I could either turn the lights off or on. Neither level was satisfactory.

In order to give a lecture from a computer, an intermediate light level is necessary, that is dim enough to make the projected images clearly visible but bright enough so that the audience doesn't fall sleep. With modern equipment, a fully darkened room is no longer necessary for computer projection. On the other hand, even with carefully designed frames, normal room lighting is often too bright. Like the story of Goldilocks and the Three Bears, an

intermediate level is just right! A dimmer switch is ideal option, but with fluorescent lights, it is more common to set the different banks of lights on several switches, so that the area over the screen can be dimmed, while some lights in the back remain on. These options may not be cheap, but saving money here may make a high-priced "smart" classroom into a white elephant.

Speaking of elephants, the remote-controlled mouse is an inexpensive way to improve computerized presentations. To give a good presentation, you should get close to the students and look directly at them as much as possible. The goal of computer lectures is not to lecture to the computer nor to hide behind a massive (and well named) bunker where the technology is located. The remote mouse lets the speaker move among the audience while still maintaining control of the presentation. The cheapest available model is usually more than adequate. Even highly experienced users may have trouble using a remote mouse to manipulate the cursor, so the only essential feature is the capability to move the frames forward and backward.

Technology support is another crucial area that is often overlooked. Several years ago our campus invited a consultant to help with our technology planning. At one point, I asked her if we shouldn't plan to have a support person available within ten minutes if there was a problem in a class. To my surprise, she responded, "Absolutely not!" Then she added, "Ten minutes is an eternity when you're standing in front of a class with nonfunctional equipment." Having been in that situation several times, I couldn't agree with her more. Help must be available very rapidly at any time that classes are being taught that use technology.

Support people are expensive, and so this is another tempting area for saving money. This is a false economy. Neither is it reasonable to assume that the individual faculty member should be responsible for emergency maintenance. Some colleagues may choose to do so, but the great majority of teachers don't wish to have this burden any more than they want to be responsible for the heating plant or the electric power. Support for evening classes is often a particularly sticky point. Some faculty may feel that this support is not necessary, but even the most experienced computer user should think carefully before accepting this extra responsibility.

Perhaps the saddest situation I have encountered in talking to early adopters of technology was a woman who had spent hundreds of hours developing a course based on presentation software, and then was told that no room would be available for her to teach the course. On most campuses, there is a real effort to build high-tech classrooms as rapidly as possible, but this is often more than offset by the even greater increase in the number of faculty who plan to use these rooms. Not too many years ago, when there were only a few early adopters who had to be satisfied, an informal commitment that a classroom would be provided was more than adequate. As the campus needs become more extensive and complex, it may well be a good idea to ask from a more formal commitment before investing so much of your time.

Next installment: Catching the students' eyes.

Changes in the CCCE Membership

Harry E. Pence
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pencehe@oneonta.edu

It is always regrettable when members of the Committee are no longer able to continue, but that is more true than usual this year. The three members who have retired have not simply made a contribution to the work of this Committee but have truly had a important impact on the teaching of chemistry. Joe Casanova and Stan Smith were among the pathfinders in the use of computer technologies for teaching chemistry. Marco Molinaro has not been working on instructional technology as long as Joe and Stan, but his contributions have still been significant. We have all enjoyed working with them and wish them the best of luck in their future activities.

The new members added to the Committee are Cathy Middlecamp from the University of Wisconsin at Madison (chmiddle@facstaff.wisc.edu) and Mike Sanger from the University of Northern Iowa (sanger@cobra.uni.edu). I'm sure that the continuing members of the CCCE look forward to working with Mike and Cathy.

FUTURE ON-LINE CONFERENCES

"General Papers in Chemistry and Chemical Education"
May 21 to July 2, 1999

Organizers:

Donald Rosenthal and Brian Tissue
Chemistry Department Chemistry Department
Clarkson University VPI & State University
Potsdam NY 13699 Blacksburg VA 24061
rosen@clvm.clarkson.edu tissue@vt.edu

"Distance and Collaborative Education Using the Internet"
July 5 to August 6, 1999

Organizer:

Brian Tissue
Department of Chemistry
VPI & State University
Blacksburg VA 24061-0212
tissue@vt.edu

"What Should Students Know When They Leave General Chemistry?"
September 1999

Organizer:

Paul B. Kelter
Department of Chemistry
University of Nebraska
Lincoln NE 68588
pkelter@unlinfo.unl.edu

"Teaching Spectroscopy"
October 31 to December 3, 1999

Organizer:

Scott Van Bramer
Department of Chemistry
Widener University
Chester PA 19013
svanbram@science.widener.edu

"The Role and Nature of Research by Undergraduates in Chemistry"
Spring 2000

Organizers:

Tim Champion and Willis Weigand
Department of Chemistry Department of Chemistry
Johnson C. Smith University Penn State University - Altoona College
Charlotte NC 28216 Altoona PA 16601-3760
tchampion@jcsu.edu waw6@psu.edu

papers being solicited

"The Use of Computer Simulations in General Chemistry"
May and June 2000

Organizer:

Denis Bussieres
Dept. des Sciences Fondamentales
Universite du Quebec a Chicoutimi
Chicoutimi, PQ
CANADA G7H2B1
dbussier@uqac.uquebec.ca

papers being solicited

"Environmental Issues and Risk/Benefit Analysis in the K to 12 Curriculum".
Summer 2000 (July and August)

Organizer:

Elizabeth W. Kleppinger
Department of Chemistry
University of Kentucky
Lexington KY 40506-0055
ursa@zeus.chapel1.com

papers being solicited

"Assessment of Chemical Capabilities"
Fall 2000

Organizer:

John Oversby
School of Education
Reading RG6 1HY UK
J.P.Oversby@reading.ac.uk

papers being solicited

"Lecture Demonstrations in Chemistry on the World Wide Web"
Spring 2001

Organizers:
Oliver Seely and Dr. George Wiger
Department of Chemistry
California State University at Dominguez Hills
Carson CA 90747
oliver@dhvx20.csudh.edu and
gwiger@dhvx20.csudh,edu

demonstrations being solicited

"On-Line Teaching Methods"
Fall 2001

Organizer:
John H. Penn
Chemistry Department
West Virginia University
Morgantown WV 26506-6045
JPenn2@wvu.edu

papers being solicited

Where it is indicated "papers being solicited", please contact the conference organizer if you wish to submit a paper.

There is no CONFCHEM registration fee
To register for CONFCHEM send the message:

SUBSCRIBE CONFCHEM your-first-and-last-name your-e-mail-address

To: MAJORDOMO@CLARKSON.EDU

You will be asked to CONFIRM your registration.

Consult the CONFCHEM Website http:// www.chem.vt.edu/confchem/, for additional details.

"General Papers in Chemistry and Chemical Education"GENERAL PAPERS SESSION SCHEDULE

May 21 - Announcement of the Beginning of the session via CONFCHEM
Listserv. Participants are expected to begin reading the papers.

May 28 to June 3, 1999

AN INTERNET SITE FOR FRESHMAN CHEMISTRY

Chung Chieh
Department of Chemistry
University of Waterloo
Waterloo, Ontario
Canada N2L 3G1
cchieh@uwaterloo.ca

June 4 to June 10, 1999

INTERPRETATION OF THE SPECTRA OF FIRST-ROW TRANSITION METAL COMPLEXES
(textbook problems)

Robert John Lancashire
Department of Chemistry,
University of the West Indies,
Mona Campus, Kingston 7, JAMAICA
rjlanc@uwimona.edu.jm

June 11 to June 17, 1999

NEW TOOLS TO IMPROVE STUDENT SUCCESS IN PROBLEM SOLVING

Bert Ramsay
Chemical Concepts Corporation
32 North Washington St., Suite 9-B
Ypsilanti, Michigan, 48197-2662
Bert@chemicalc.com
(Emeritus Professor of Chemistry, Eastern Michigan University.)

June 18 to June 24, 1999

DEPARTMENTAL COMPUTER LABS - Issues to Consider

Iris K. Stovall
Program Coordinator, Illinois Online Network
University of Illinois
Urbana IL
istovall@uillinois.edu

June 25 to July 2, 1999
Evaluation and Discussion

ON-LINE CONFERENCE ON "TEACHING SPECTROSCOPY"
OCTOBER 31 TO DECEMBER 3, 1999

The focus of the conference will be: Developments in spectroscopy and innovative strategies for teaching spectroscopy in the undergraduate curriculum.

Spectroscopy is used throughout the undergraduate chemistry curriculum and spectroscopic techniques are undergoing continual innovation. As a result, it is a challenge to decide what topics to teach and when to teach them. This conference will highlight recent developments in spectroscopy and introduce innovative teaching techniques. An additional goal of this conference is to generate discussion about teaching spectroscopy at all levels of the undergraduate curriculum.

This on-line conference will be held utilizing the World Wide Web for distribution of abstracts and papers. The home page for the conference is: http://www.chem.vt.edu/confchem/1999d/

Questions and discussion will occur using Listserv. The final version of the material for discussion will be available on this page three weeks before the start of the conference. There is no registration fee for this online conference. OnLine discussion will occur on the CONFCHEM Listserv.

To register, subscribe to the Listserv by sending the following text in the body of an email message to listserv@CLVM.CLARKSON.EDU.

SUBSCRIBE CONFCHEM your first name your last name

An acknowledgment message will ask you to confirm your subscription within 99 hours. The acknowledgment message will contain more details as does the CONFCHEM instructions page

The Conference schedule, list of speakers and titles of papers are presented below. Abstracts for each of the papers are presently available via the World Wide Web.

For additional information, contact
Session Chair:

Scott Van Bramer
Department of Chemistry
Widener University
Chester, PA 19013
svanbram@science.widener.edu
610/499-4516

For CONFCHEM Listserv problems contact Donald Rosenthal (rosen@clvm.clarkson.edu).
For problems with the CONFCHEM webpages contact Brian Tissue (tissue@vt.edu).

Schedule for Fall 1999 ConfChem Teaching Spectroscopy

October 1, 1999. Papers available online.

Week 1, October 31, 1999
Opening discussion.

Week 2, November 7
Sunday, Monday, Tuesday: Paper 1 Teaching Infrared Spectroscopy in General Chemistry Using Interactive Animation by Charles Abrams, Beloit College.
Wednesday, Thursday, Friday: Paper 2: Making Connections Between Spectroscopy and General Chemistry. A Series of Practical Exercises by Walt Volland, Bellevue Community College.

Week 3, November 14
Sunday, Monday, Tuesday: Paper 3 Development and Student Use of Web-Based Prelabs in Analytical Chemistry Courses by Mark R. Anderson and Brian M. Tissue, Virginia Polytechnic Institute and State University.
Wednesday, Thursday, Friday: Paper 4: Interactive Visualization of Infrared Spectral Data: Synergy of Computation, Visualization and Experiment for Learning Spectroscopy by Robert J. Lancashire, University of the West Indies and Paul M. Lahti, University of Massachusetts.

Week 4, November 21
Sunday, Monday, Tuesday: Paper 5 The Spectroscopic Workstation: A Modular Approach to Teaching Optical Spectroscopy by George R. Long and John C. Ford, Indiana University of Pennsylvania.
Wednesday, Thursday, Friday: Thanksgiving Break

Week 5, November 28

Sunday, Monday, Tuesday: Paper 6 Teaching Advanced Spectroscopy to Undergraduates Anton S. Wallner, Missouri Western State College.

Wednesday, Thursday, Friday: Closing Discussion.

SEPTEMBER 1999 ON-LINE CONFCHEM

WHAT SHOULD STUDENTS KNOW WHEN THEY LEAVE GENERAL CHEMISTRY?

Organized and moderated by:

Professor Paul B. Kelter
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pkelter@unlinfo.unl.edu

General chemistry is a course that serves a vast and diverse student audience. Deciding what students need to know upon finishing the course is difficult because the audience is so varied. For example, how are the needs of pre-medical and pre-health students different from those of agriculture majors? What does the chemical industry think that students ought to know? What is needed for the one-semester vs. two-semester course? How do faculty define a student "need" vs. a faculty "preference" in the curriculum? What are some creative ways of dealing with diverse needs?

The CONFCHEM Discussion List and Website will be used for
this session.

Authors of papers and their titles:

1. John Kenkel (Southeast Community College, Lincoln, NE) "On the Virtues of Industry-Based General Chemistry."

2. Carlos Castro-Acuna, Ramiro Dominguez-Danache, Mercedes Llano-Lomas and Graciela Muller-Carrera (Universidad Nacional Autonomade de Mexico) "General Chemistry at UNAM : Providing Our Heterogeneous Student Body with a Launching Platform to Succesfully Pursue Chemistry Careers"

3. Gabriela C. Weaver (Chemistry Department, University of Colorado at Denver) "Creating a Scientifically Literate Citizenry: What are the Long-Term Lessons that Students Should Take Away From General Chemistry?"

4. Brian Coppola (Department of Chemistry, University of Michigan at Ann Arbor) "Decisions, Decisions..."

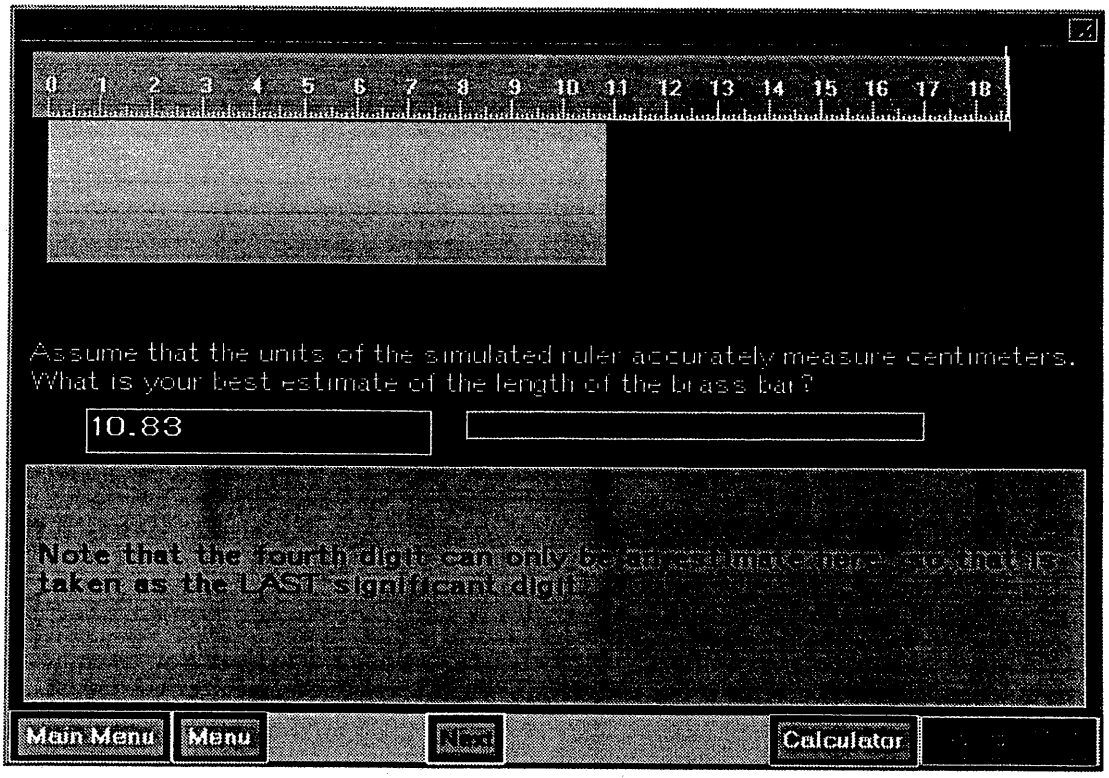
5. Connie Murphy (Dow Chemical) "What Chemists in Industry Need to Know" (tentative title)

ELECTRONIC HOMEWORK REVISITED

James Spain, Electronic Homework Systems, Inc., 129 Leslie Lane, Pendleton, SC 29670, jspain@clemson.campuscwix.net

About four years ago, this Newsletter reported that Electronic Homework Passes First Large Scale Test (Appling, J and Spain, J., *Computers in Chemical Education Newsletter*, Spring 1995). This article dealt with the use of CHEMI-SKILL-BILDR by 1200 students in the General Chemistry class at Clemson University during the fall of 1994. The objective of this paper is to bring you up to date on the ChemSkill Builder (CSB) project.

The general term electronic homework refers to any system that uses computers to generate personalized homework questions and problems for students, maintains a record of student success and uses electronic means to transfer this record to the instructor so that credit for the work may be awarded. The CSB system is different in that: 1) it is based on a computer disk that the student purchases in the bookstore for a relatively small amount; 2) it provides full explanations of incorrectly answered questions and problems; 3) it



Sample Screen 1

maintains the student record directly on the disk which may be used at any location the student chooses to work; 4) it employs grade management programs that are provided without cost to adopting departments; 5) it requires no site license for departmental use.

Students hand in their homework by bringing their disks, containing the record file, either to a single master computer, or to a network of computers, where the transfer program is available. This program causes student records to accumulate in a class file from which they are accessed for analysis by a grade manager program. This results in summary data that can be viewed in a variety of ways and easily combined with the overall class record file. Typically, schools give 5-10% credit towards the final grade. We recommend keeping the credit as low as possible, as the major objective is to improve overall student success in chemistry. The credit is simply an enticement to get them started using this study aid. The individualized problem sets prevents students from simply copying from one another. However, there is no way to prevent one student from doing the work for another, though we believe that the time required to do this is a major deterrent.

The initial programs were written in QuickBasic and designed to be used with PC computers running on DOS. As a result, computer graphics and student interaction was restricted. Despite these limitations, the number of client institutions grew to about 20 during these first two years of operation and the total number of packages sold increased to 20,000. Faculty and student reaction was generally very positive. During the summer of 1995, Spain was joined by Dr. Harold Peters (who had previously been Director of CONDUIT, the educational software clearinghouse at the University of Iowa). Peters began work on a new ChemSkill Builder for Windows, using Visual Basic. This provided an opportunity to develop many new kinds of student interaction as well as being more pleasing visually. CSB/WIN, Version 4.1. was released in the fall of 1996, consisting of two disks, one for each semester, packaged in jewel cases. This all worked as long is the Iinstructor didn't want to employ the units from both disks during the same term, as the grade management system didn't allow overlap. Another disadvantage of Ver. 4.1 was that it was possible to have only 10 chapters on each disk, with the total limited to 20 chapters. During the 96-97 academic year, all software was sold by WCB/McGraw-Hill, either individually or in combination with their texts. However, this arrangement didn't work out, so the responsibility for individual disk sales was returned to Electronic Homework Systems, Inc in the summer of 1997. Since then we have contracted out CSB production and sales to Midwestern Diskette Center of Creston, Iowa. This is a large duplication center that has been very effective in providing a quality product to meet the needs of our client institutions. Meanwhile, WCB/MGH has continued to provide CSB bundled with their texts.

CSB/WIN, Version 5.1 was released in the fall

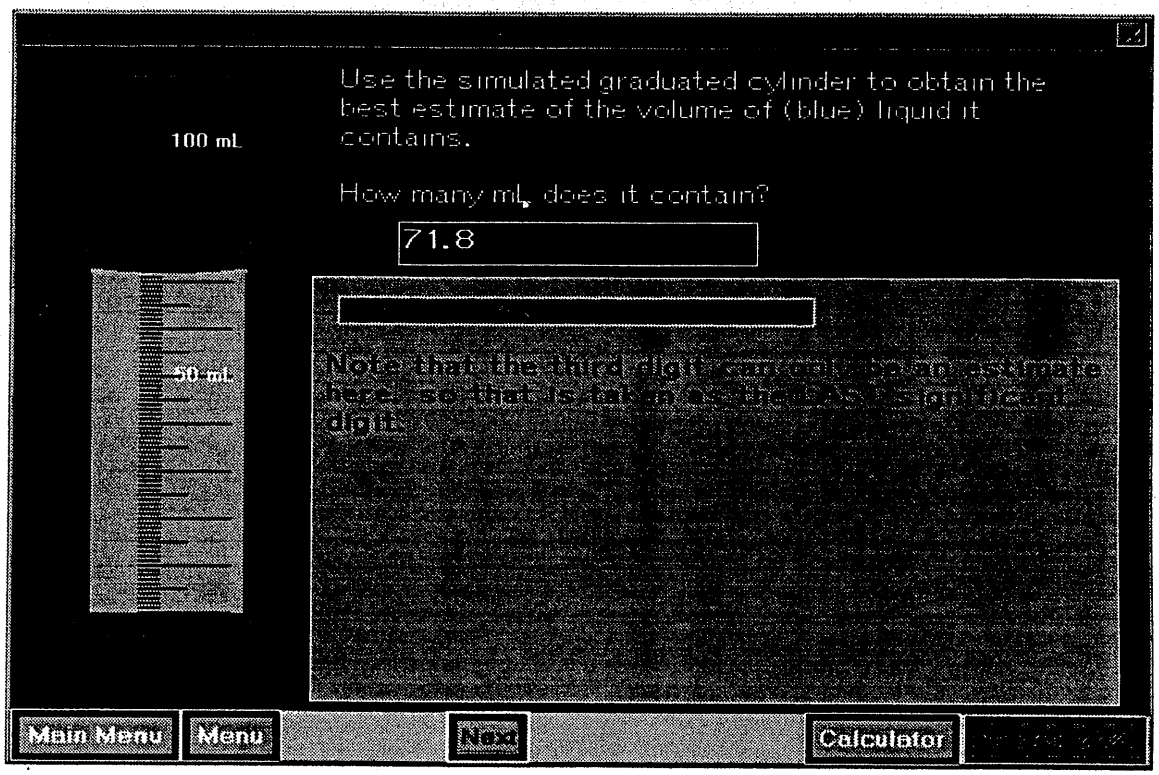
of 1997. This consisted of the full 24 chapters of material either on a CD-ROM or three floppy disks. At the same time, the grade management system was restructured, using Visual Basic, so records of all 24 chapters were in a single data file, eliminating the problem of assigning materials from both semesters during the same course. The CD-ROM with record-keeping disk was found to provide many conveniences over the floppy disk, the most obvious being that it was not subject to virus problems. All new software was packaged in a much more attractive and protective plastic folder. This package was reviewed recently by M. Larry Peck in the Journal of Chemical Education (1998(75) 831 [Jul]), where he stated that ChemSkill Builder should be considered by all criteria to be one of the best General Chemistry electronic homework packages... The program was found to be friendly. It is easy to use, has large visuals, gives friendly comments, is patient, gives immediate feedback, and (the record of student activity) is very well encrypted.

In the fall of 1998, we released ChemSkill Foundations, new software that was designed for introductory or prep chem. courses. This package started at a lower level than CSB and provided more graphical explanations than had been employed before. For example, we developed a simulation of gas behavior that was intended to provide an intuitive understanding Lewis dot structures, pH meter, crystal structure, simple measurement and significant figures. As they were being developed, we could see that these sections would have significant value in the CSB package as well. We also learned much from the faculty review of CSF that will be of value in restructuring and upgrading CSB.

It appears that our software is meeting a need and that the marketing strategy of selling it directly to the students, rather than using the site license approach, is a successful one. The number of client institutions who purchase software independent of texts has grown to over one hundred and some, such as the University of Georgia and the University of Florida, have continued to employ our materials and contribute to program development since the inception of the project. This fall, EHS will have been in operation for five years and will pass the 100,000 mark in the number of student packages sold.

Peters and Spain continue to work full time on product development. Planned for release in the fall of 1999 is the NEW ChemSkill Builder/2000. This package will provide all the features of CSB, Ver. 5.1, plus most of the features of CSF, plus additional sections in the second semester CSB to result in 25 units (chapters), plus an appendix, all provided in a CD-ROM

system that will accompany this allows the instructor to



Sample Screen 3

pick and choose sections for assignment from any of the 25 units provided. This will allow CSB/I2000 to be used with either general chemistry, or elements of chemistry texts. CSB Ver.5.1 and CSF Ver.1.2 will be available for users who wish to continue with these products.

Also under development at this time is an electronic homework package for the short course in organic chemistry. This is being designed and programmed by Pienta, Kessler and Associates at Chapel Hill, North Carolina. This software will make use of the same grade management system that has proven so successful for CSB and CSF. The name for this new package is yet to be decided, however one possibility is OrganoSkillBuilder or O-Chem SkillBuilder. Individuals who would like to ask questions about, or contribute ideas to this project are invited to contact Norb Pienta at: **pienta@pyrite.chem.unc.edu**

Further information about CSB or CSF may be obtained by visiting our homepage: **http://www.avalon.net/~chemskil/** From this you may download sample copies of the first third of either CSB or CSF. These are complete except for the ability to retain a record of student work on the disk and may be used to test the pedagogy of our software on first semester chemistry students. If you have any questions relating to our materials, please feel free to contact me by e-mail or call me at: **1-800-836-3949.** I look forward to hearing from you.

Evaluating WWW Search Engines for Chemistry

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INTRODUCTION

In a relatively short time, the World Wide Web has become a widely used source of chemical information for both college students and faculty. At its best, the Web is a rapid and convenient method to search for information; at its worst, it can be frustrating and time wasting. Frequently, the difference between success and failure at using the Web depends on the search engine chosen. Thus, search engine selection can be a critical decision for chemists who use the WWW.

For many Web users, including some chemists, the choice of a search engine is based more on Web location or external advertising than any other criteria. Engines that are well placed on popular Web portals or are widely advertised in the media seem to do much better, regardless of how useful they are. This selection process may be adequate for casual surfers, but chemists need to be more selective if they expect to find the specialized information they need.

Many popular computer journals review search engines, but these evaluations are intended for the general user. A good summary of such reviews is available on the Web.(1) One effort to focus specifically on chemistry is "Best Search Engines for Finding Scientific Information on the Web." (2), which was developed by Alexander Lebedev of Moscow University. On August 3, 1996 and on February 10, 1997 Lebedev compared the number of hits recorded by eleven different search engines for eight different keywords important in physics and/or chemistry. He discovered that the number of hits could differ by several orders of magnitude from one search engine to another. Unfortunately this work has not been updated since May 17, 1997.

The rate of change on the Web is so rapid that Lebedev's results need to be reevaluated. Even in two years there have been important changes, including the elimination or modification of some search engines in the original study. In May of 1999, the senior chemistry seminar class at SUNY Oneonta set out to update Lebedev's results.

CRITERIA FOR SELECTING A SEARCH ENGINE

There are at least three important criteria that should be used to evaluate search engines, comprehensiveness, currency, and efficiency. Comprehensiveness is a measure of what fraction of the total web sites the search engine actually reviews. This is particularly important for chemists. An article by Lawrence and Giles (3) reported that not all Web sites can be accessed by search engines and even the best of the search engines misses over a third of these accessible sites. Since engines are more likely to identify popular sites, that is, those with many links to other pages, this partially explains why chemists cannot find the specialized pages they need.

Currency measures how often the search engine revisits its sites to determine whether or not there have been any changes. Not only are new web sites constantly being created, but also many sites are vanishing. Failure to keep up to date can produce useless links that no longer exist. In September, 1998, a further study (4) by Lawrence and Giles concluded that the Web is growing faster than the increase in the search engine coverage, and engines are returning a greater percentage of dead links. The situation is getting worse, not better.

The final concern is efficiency. Are the most useful sites not just included but listed early in the search results? This is probably the most difficult to evaluate quantitatively.

Lebedev argues that the number of documents is most important when looking for scientific information and so focused mainly on comprehensiveness. He argues that the number of scientific publications is only 10-20% of the total number of documents found by search engines, and so listing more documents increases the probability that nothing useful will be missed. This approach ignores two other important criteria mentioned above, currency and efficiency, but it does provide a helpful perspective for chemists.

Lebedev chose a short list of scientific terms and recorded the number of hits for each term on each search engine. He found that the number of hits changed by several orders of magnitude from one search engine to another. Based on his results, he recommended AltaVista as the most comprehensive search engine.

SEARCH ENGINE RESULTS

During May of this year, students in the senior seminar at SUNY Oneonta repeated the survey that had previously been done by Lebedev, with several changes. The list of Search engines used was modified by eliminating those that gave very few hits with scientific search terms, as well as those that had changed format in such a way that they no longer could be compared. Yahoo, which is highly rated for general use, consistently returns very small numbers of hits for these scientific terms, and so was eliminated. Two search engines, Northern Light and Microsoft Network, were added, since these are reputed to give good results. A slightly shorter list of search terms was used. The results are shown in Table I below. The 1996 and 1997 results are from Lebedev's study and the 1999 results are the current project.

DISCUSSION

Several of the trends reported by Lebedev are continued with the most recent data. During the period from 1996 to 1997, two search engines, Inktomi and NlightN, terminated or became inaccessible. Since then, Magellen has changed to focus mainly on forming chat groups and Lycos no longer displlays the number of hits. The number of hits recorded with Excite decreased in each case from 1996 to 1997, and these values were, in turn, even less in 1999. AltaVista usually returned the greatest number of hits. Although Lebedev reported

TABLE I

	AV	HB	EX	IS	NL	MN
crystallography						
96	31186		24975	1464		
97	28597	25232	15360	11513		
99 1	20365	28530	12260	21123	42108	18794
catalysis						
96	27431		18061	550		
97	21841	18521	12308	9471		
99	73020	23340	7902	17163	37397	13988
benzene						
96	27533		17304	374		
97	24764	19879	12372	8875		
99	51488	27745	9351	17538	51217	15315
luminescence						
96	9731		7231	206		
97	7597	8103	5733	4104		
99	11228	10490	4144	8397	21604	6539
ferroelectric						
96	8354		4362	166		
97	5622	4579	2983	2439		
99	7091	4810	1846	3820	14402	3652
EXAFS						
96	3144		2167	64		
97	2677	2225	1639	1005		
99	3501	2450	963	1446	4595	1713

AV=AltaVista, HB=HotBot, EX=Excite, IS=Infoseek,
NL=Northern Light, and MN=Microsoft Network.

that the number from AltaVista declined from 1996 to 1997, and the latest data generally shows these values have increased, often quite substantially. Northern Light, which was not among the engines in Lebedev's study, competes best with AltaVista, and in some cases even provides more hits.

There are several alternative sources of evaluations that tend to confirm these results. One of the most useful sources of information about search engines is the Search Engine Watch site edited by Danny Sullivan. This site compares search engines in several ways, including the size of each search engine's index (5). The most recent results from that site (May 1, 1999) indicate that AltaVista has the largest index, followed by Northern Light, then Inktomi (used by several engines, including HotBot and MSN). A larger index indicates a greater chance of finding unusual information, which would presumably include chemical terms.

The article by Lawrence and Giles (3) reports that the most comprehensive engines are HotBot (which is powered by Inktomi), AltaVista, and Northern Light (in that order). In their later report (4), they note that in comparison to their previous study, Northern Light has significantly increased its coverage relative to the other engines, and the difference between the largest and smallest coverage of the engines is not as great. All of these results are in agreement with the results obtained in this paper. Finally, it should be noted that Lawrence and Giles found that Northern Light, Microsoft Network, and Lycos returned about twice as high a percentage of invalid links as the other engines.

CONCLUSIONS

Perhaps the most important conclusion from the available data is that no single search engine covers the entire WWW, and so a really through search would require the use of more than one engine. Even though a number of engines now have roughly equivalent indexes, AltaVista still seems to be slightly better for use by scientists, with Northern Light giving results that are almost as good and sometimes may be a little better. It is possible to search multiple WWW engines by using a metasearch engine, like Dogpile (6), but these are usually limited in the number of hits that are returned. Instead of crawling the web to build an index, metacrawlers send search terms to several search engines, then combine the results. Finally, it is clear that the WWW is still in a state of rapid development, and even these conclusions must be considered to be tentative, until the next new development. A more extensive repokrt of this project is available on the WWW (7).

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6. www.dogpile.com/
7. www.oneonta.edu/~pencehe/engineselect.html

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