# Teaching Chemistry Students Using Blackboard as a Platform for "e-education"

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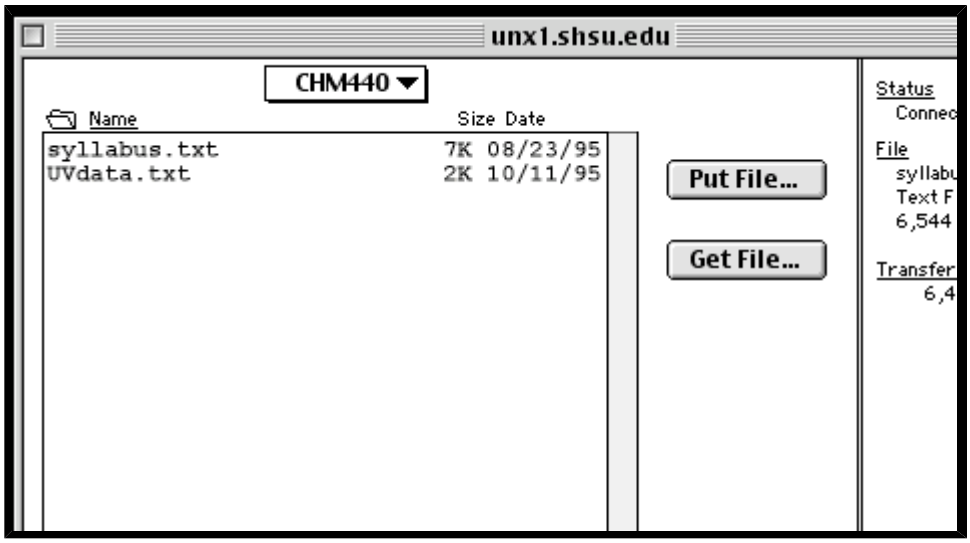
Beginning in about 1994, I wanted to augment my senior level instrumental analysis course with a data set extensive enough that it would, unfortunately, be too onerous for my students to type in from a paper handout. Passing around floppy disks was possible but this process had its own drawbacks. An alternative was for students to download an ascii file from our university server using FTP (file transfer protocol). The exercise involved logging in to a directory on our UNIX server from a network prompt, locating the file in a sub directory, initiating and completing the download, saving the file on a floppy or hard drive, and then importing the file into Microsoft Excel®. I assigned this "experimentally" at first.

first there was **file transfer protocol**




Once I realized that the students were enjoying the quick, always available, anytime nature of the assignment, I started to increase the kinds of things we made available online. Soon we were offering a copy of the course syllabus, detailed instructions for the laboratory reports, and other data files. We were moving to the e-education or computer aided teaching support of a traditional chemistry course in a relatively natural and obvious manner.

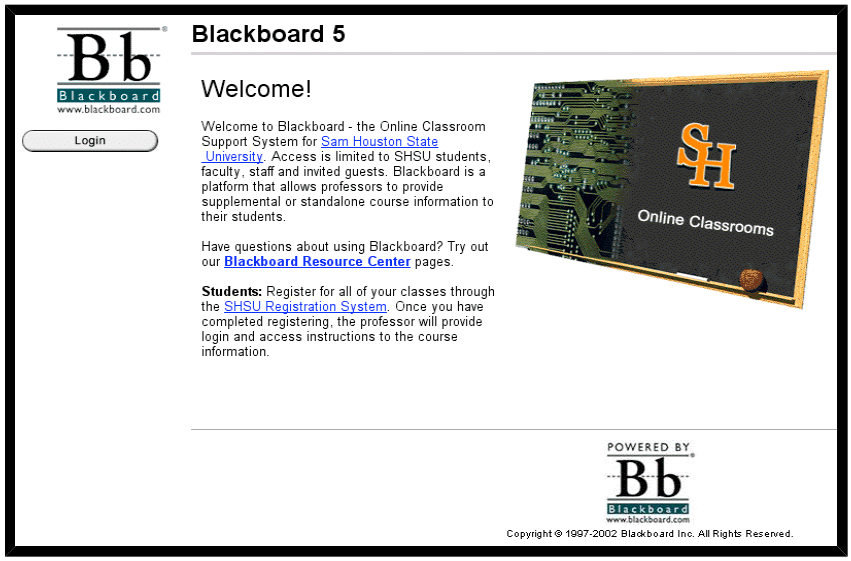
Soon my students were accessing the files in our FTP directories using a browser (Mosaic® then Netscape®) and then we started to worry about formatting documents in HTML, providing images of instrumentation, and arcane aspects about how cutting and pasting data columns into Excel are effected by differences between Macs and PCs, etc. Soon last minute changes in our lab procedures were posted as HTML documents the week before the lab. These were often last minute changes necessitated by the TA herself who discovered that reagent volumes or identities needed to be changed from what we had used in the previously "published" procedure as she prepared the experiment for the next week.

Soon my university had a chance to get in on the beginnings of a "software Package" aimed at universities, and we began to use **Web Course in a Box**® (WCB). This collection of server-based files used what I still consider some innovative HTML and javascript coding by programmers originally at Virginia Commonwealth University, Sue Polyson and Bob Godwin-Jones.

web course **in a box**

This is the first time I started to use a program that wrote HTML for me--not because I was HTML challenged--but because the WCB page construction software was quicker then I could code and more easily inserted URL links and images that I could have more slowly provided with my homemade coding. It also supplied on-line discussion forums and computer graded quizzes that I had never had available before. WCB soon took the place of all the disparate online pieces that I used to teach online up to that point.

I still constructed content such as instrument schematics for my instrumental course and animations using drawing programs, GIF animators, and QuickTime® (see here) but I could then easily make it available in different courses using links on course pages, course pages inside an online course environment that students in each class logged into. Also, cosmetically, WCB created a consistent look across pages inside the same course and among different courses. In this way, navigation became substantially more systematized and easier for students to use in different WCB-augmented courses.




A few years ago WCB was absorbed by Blackboard®. Fortunately importation of WCB-based courses pages was supported (rumor was again Sue and Bob were working hard) and so we became a Blackboard-based university. Now I use Blackboard-based course work in my courses from freshman though graduate classes.

So there you have the history of how I got into "e-education." Now all my courses have some on-line content. And although we do offer a completely on-line freshman chemistry course (sans lab) the courses described here only fit what Walt Vollard would probably termed "server-supported."

Pretty mundane? In my experience this is a relatively common manner of adopting teaching tools: we choose the tools that we see can provide a benefit. We try lots, discard lots, and keep some. I don't use overhead transparencies in my classes but find use for computer-based PowerPoint® and QuickTime® displayed via a laptop and a projector. E-mail has proven to be something almost indispensable in my teaching...a high speed streaming video server has yet to prove its worth to me in my course work (and I'm the heaviest user of computer animations and video in my department).

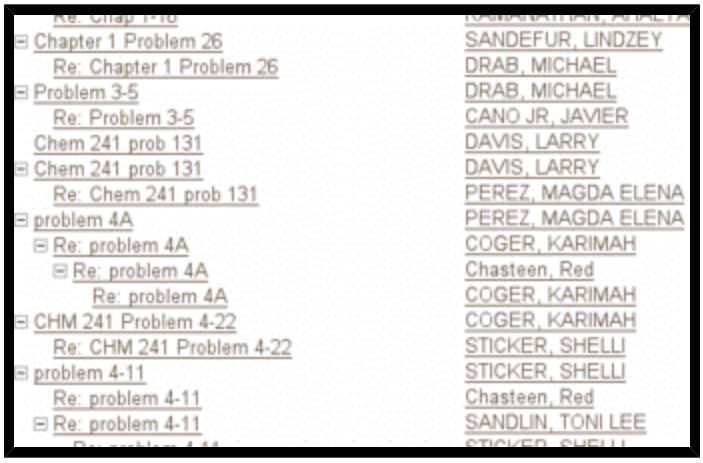
I rely heavily on Server-based forums (or discussion groups) in all but my freshman and graduate courses, but so-called virtual chat rooms or white boards just don't find a place in my courses even though these are part of the Blackboard package. Finally, I use white chalk but find the texture and consistency of color chalk decidedly unappealing and frankly hard to use, so I don't.

# blackboard as a platform for network-based course material

The following is a short listing of how I use online computer- and network-based support of courses at each undergraduate level that I routinely teach. The benefit to me and my students at each level and course is slightly different and, I think, useful to highlight here. I've divided each level up and will

describe each separately. (If you'd like to view some of the Blackboard-based course work, you'll need to turn on cookies in your browser. The most recent release of Blackboard is heavily dependent upon cookies to help its pages and (I guess) data base access and display.)

### Freshman Chemistry




These students, in an introductory freshman chemistry course, are given a copy of the syllabus on the first day of class but my online support material is introduced the first day also (for a guest trip though this course see here and click the small preview button). They can find extensive online lessons (see/click the Blackboard *Course Documents* icon) reiterating the lecture material. This material I wrote myself--though it is in a general way tied to our lecture text (Brown and Lemay 9th edition)--and it is augmented with a few GIF animations, many color images, a few animations in various file formats, sound comments to connect students to the material through audio-based learning files, and even a comic sound or two for fun. Again Dr. Volland would term this a "blended class." But the most useful computer-based support materials for my freshman are practice quizzes (<-----a screen shot only) and qualifying exams (see Blackboard *Assignments*). [The associated freshman laboratories' procedures are in a traditional paper laboratory manual that the department publishes. Example daily quizzes for these labs are also online in a separate Blackboard "course."] I use ongoing results from assigned practice quizzes as a measure of what course material needs more emphasis; Blackboard allows question-by-question evaluation of the quiz results, by student and/or by group. These quizzes allow a way to evaluate student progress between hour tests without taking up class time.

A qualifying exam is an effort to help these students avoid significant surprises. I require these students to take the online qualifying five days before each test to help them prepare for the test. The qualifying exams are multiple choice, ordering, and true and false and graded immediately automatically. Blackboard records the result of the exam and both the student and I can see the score. All the practice quizzes and qualifying exams scores can be accessed online.

## qualifying exams as a teaching tool for freshman

At this point I'm not requiring a specific score on the qualifying exam to take the in-class lecture exam but instead merely require a recorded score before the in-class test can be taken. And no, I have not statistically evaluated the relationship between scores on these quizzes and qualifying exams and the associated tests or course grades (correlated? anti correlated?). I'm still experimenting with this teaching tool. The purpose in my eyes is to help students--who are often poor judges of how that can do on an in-class exam--get feedback of their progress before it "counts against them."

### Sophomore Quantitative Analysis

This course requires an online Excel primer associated with the lab. These files and extensive laboratory procedures are also on-line (here, click the preview button). In this course, I reinforce my emphasis on assigned homework problems by having them post worked-out (assigned) problems a week before the associated test and then also double check others' posts online. Incorrect problems are corrected by the students themselves--with me spot checking--always leaving the original problem post for comparison. Students are especially good at this kind of interaction and almost invariably show kind, gently respect for each other even while correcting relatively serious mistakes in the initial post. Though like most chemistry texts these problems' numerical answers (the even numbered problems any way) are in the

back of the text, but the posting focusses on the problem solving method, not the answer. Students are required to post the answer in a relatively detailed manner and they receive points for their posts.

part a is correct, but i'm confused about what you did on the second part.

this is how i calculated it:

$CaCl_2$ is completely soluble, so you already have .5M Ca in solution.

when you add the $CaSO_4$, and it goes to equilibrium, the equation you will get is:

$[x + .5][x]=2.4 \times 10^{-5}$
you neglect x in the first conc. so you get

$.5x=2.4 \times 10^{-5}$
$x=4.8 \times 10^{-5}$

convert to g/mL:
$4.8 \times 10^{-5}/1L \times 136.14g/1mol$
$=6.5 \times 10^{-3}g/ml$

i hope that makes sense

The result is ultimately a totally (student-completed) worked-out problem set for each test and, in all fairness and support of these hard working students, some of each in-class test's material comes from these problems.

url links to material on the web

### Junior Environmental Chemistry

My environmental chemistry class also involves server-based materials. Homework discussion forums are used as before and as always, announcements are routinely posted with the goings-on of the course: updated schedules for the Friday afternoon, extra point seminars of outside speakers, corrections to the erroneous back of the textbook answers (always a popular item), and because so much environmental material is on the web, *External Links* get an especially heavy use in this course. Here is a sampling from linked items from spring 2002:

- Texas Natural Resource Conservation Commission's Ozone Animation Page
- NASA's Ozone and the Atmosphere's Page
- NASA's Ozone (Total Ozone Mapping Spectrometer) Multimedia Page
- MSIS-E-90 Atmospheric Model Page
- Internal Combustion Engine animations (How Stuff Works) Page

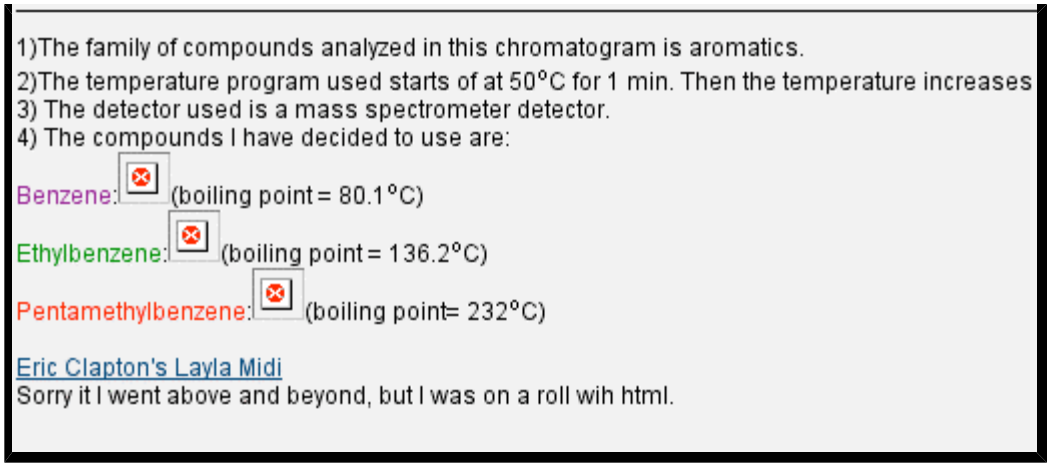
### Senior Instrumental Analysis

The online material for Instrumental Analysis incorporates an entirely online laboratory (that is the students' instrumental procedures are online) along with online quizzes to keep students prepared for the labs. And there are also required forum posts, but in addition to the assigned text problems--and an evaluation of someone else's post--to increase their involvement with the course there are usually about 3 or 4 different topics in class each semester that lead to additional assignments for the student forum. These usually involve assigned materials that must be "processed" and must result in a student forum post. Example assignments from fall 2001:

- a schematic or detailed description page of a gas chromatographic (GC) detector link from the

**Current Forum:** Chromatography Posts
**Date:** Wed Oct 17 2001 12:41 pm
**Author:** HOPENWASSER, JAY <STDJRH18@shsu.edu>
**Subject:** Aromatics in Finished Gasoline, pg 326

web and an associated chromatogram from that detector
- a search for the highest boiling point compound that we could find published in commercial GC chromatograms either on the web or in commercial chromatography manuals donated to us (by Allen Vickers at J&W Scientific, an SHSU alumnus)




- a listing of three members of a chemical family analyzed by GC, complete with the retention times of the analyte molecules, their known boiling points, the GC detector used and the chromatographic conditions used for their separation.

These assignment forum posts are also augmented/formatted by the students in a manner that makes use of simple HTML coding. The students are given a short HTML primer (here then click preview) for coding that works inside Blackboard's forums, and told that they must format at least two items in each of their posts using HTML. The student in the adjacent figure used the HTML-based temperature degree signs and a bit of color. Surprisingly students have taken to this additional forum posting requirement easily. I think many of these students, who as a group are very computer- and web-savy, are interested in HTML code because they have seen so much flashy content on the web. The red Xs in the adjacent image (as I recall) were links to a GIF image of the molecules he had chosen for his assignment. This student also included a link to a digital attempt at arguably Eric Clapton's most famous song, again using HTML code to insert the link. Students' interesting in writing in chemistry, I think, helps them understand more of what they read and write. And who can disparage interest in Eric Clapton's lead guitar!

Finally these students are exposed to animations to teach selected instrumental methods, but that was covered elsewhere.

# html coding assignments for spice

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## On-line Bibliography


www.blackboard.com commercial site
Blackboard courses discussed above:
Freshman Chemistry, CHM 138 (then click the little preview button)
Quantitative Analysis, CHM 241 (then click the little preview button)
Environmental Chemistry, CHM 368 (then click the little preview button)
Instrumental Analysis, CHM 440 (then click the little preview button)
Casanova, R.S.; "Student Performance in an Online General College Chemistry Course"; CONFCHEM

Fall 2001.
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Clapton, E.; Gordon, J.; Layla from Album "Layla and Other Assorted Love Songs" by Derek and the Dominoes; Polydor Records; 1970.
Combs, L. L.; "Web Courses in Freshman Chemistry"; CCE Fall 2002 Newsletter.
McGoldrick, B; "The Genesis of an Online Chemistry Course"; CCE Fall 2000 Newsletter.
Parrill, A.L.: "Everyday Chemical Reactions: Promoting Interest and Learning Through Relevant Writing Assignments"; CONFCHEM Fall 1998.
Smith, S; Stoval, I.; "Networked Instructional Chemistry"; ONNFCHEM Summer 1996.
Voland, Walt; "Why add an on-line course to the curriculum?"; CCE Fall 2000 Newsletter.

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