Advanced Technology: Multimedia in a Large Class†

Cyndi W. Porter,* Roger W. Strassburg, Kenneth Bower, Charles Bower, Robert Ferrante, and Dean Frate

Department of Chemistry, The University of Akron, Akron, Ohio 44691-3601

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As chemists, we are well aware of the need for constant change in our field of research. When it comes to teaching, however, the old standby of chalk and blackboard seems to be the only method of teaching. Using the latest in advanced multimedia, we are able to generate an exciting and visual demonstration of the basic concepts of chemistry. This paper will include a general review of the equipment used in our multimedia classroom and the instructional techniques used in lecture.

INTRODUCTION

In recent years, a common ailment has afflicted the science fields. How do we as educators deal with the declining number of scientists[1] being produced yearly at institutions of higher learning? In an effort to increase student interest in chemistry, as well to enhance the learning process by imparting the concepts in a visual and demonstrative manner,[2] The University of Akron has embarked on an exciting and novel method of teaching freshman chemistry.

Using the latest in advanced technology, we have developed a multimedia classroom which is used in teaching our Principles of Chemistry program. In this large lecture hall we have assembled all of the equipment needed to produce professional lectures and demonstrations. Commonly used in the classroom are interactive video disk programs, VHS tape sequencing, computer generated slide projections as a lecture outline, and on-camera live productions of classroom demonstrations.

EQUIPMENT

The acquisition and setup of equipment for an advanced technology lecture hall is a process constrained by the need for high durability, outstanding performance, ease-of-use, reasonable cost, competent installation and training, and security concerns.

A video projector, large motorized screen, studio camera, tripod, equipment cabinet, and VCRs are all a necessary part of a classroom of this type. Figure 1 shows the configuration we utilize in the lecture hall. Two VCRs, two computers, the studio camera, the slide interface and the main library media distribution center are all connected to the projector. The computers used in the lecture hall are both equipped with VGA graphics cards. One computer is used to process the computer generated lecture slides used in class. The second computer is an InfoWindows system which directs our use of interactive video in the classroom. In addition to the configuration shown, we have added a stationary, ceiling mounted camera and movable podium. Inputs from any of these sources can be instantaneously switched to the screen with the press of a button on an IR remote controller.

While prerecorded demonstrations and experiments are periodically used in lecture, we feel strongly about the value of live demonstrations that can be clearly seen by all students in the lecture hall. The need for enhanced visibility guided our selection of the camera system used in our lecture hall. Use of the studio camera allows us to demonstrate small scale, safe experiments. The camera is focused on experiments conducted in the fume hood, where even single crystals can be shown clearly to the students.

As previously mentioned, we have installed an overhead camera to supplement the tripod mounted studio camera for demonstration enhancement. The overhead camera is mounted in the ceiling and provides a focused beam of light down to the podium, where drawings, pictures and writing can be picked up and projected, via the video projector, to the large screen. Additionally, we have added a slide projector to the podium, allowing us to show 35-mm slide presentations. The use of the podium and overhead camera system is clearly an improvement to using the blackboard, as these images can be seen in the back of the lecture hall.

A laser pointer provides the lecturer with a means of highlighting areas of the screen. Together with two mounted red-light sensors on either side of the screen, the laser pointed also provides a way of advancing or reversing computer slides. These light sensors were designed and built for about $400 and are connected to the computer through the game ports.

LECTURE SLIDES

At the center of our teaching strategy is the use of computer-based lecture slides. A commercial presentation package, IBM's Storyboard, has been used to develop a series of lecture outlines. These lecture outlines have been adapted to display the concepts of chemistry on the large motorized screen in our lecture hall. These lecture slides are projected onto the large screen allowing all in the class to clearly follow the lecture outline. In addition, the students taking the class have purchased study guides which contain hard copies of the lecture slides. This allows students to follow the lecture without taking the time to copy tables and drawings from the lecture slides. When taking notes, students can write them directly on the lecture slide being discussed.

The technique of using the lecture slides varies from class to class. Instructors may use the slides as lecture guides or as summary tools. Both techniques are currently used in our program and have been found to be successful. Due to the diversity inherent to a program which involves several different instructors, sets of lecture slides have been developed to fit the teaching styles of the individuals.

In answer to the need for producing and altering the lecture slides for individual instructors, we have established two work stations. Figure 2 shows the configuration for the work stations and ancillary equipment. Three computers with VGA graphics

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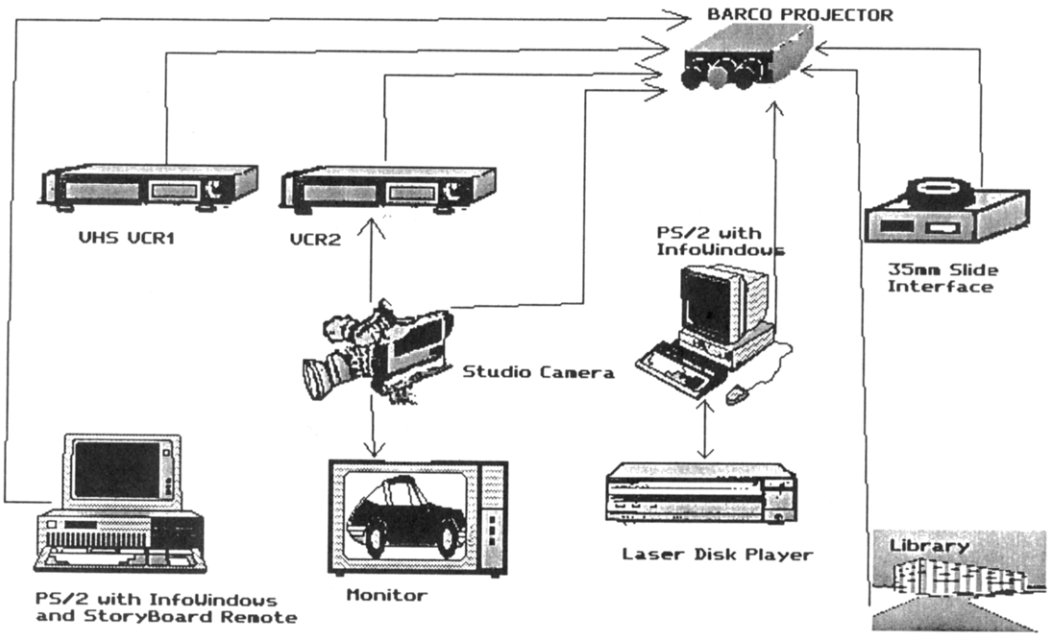

Figure 1. Lecture hall configuration.

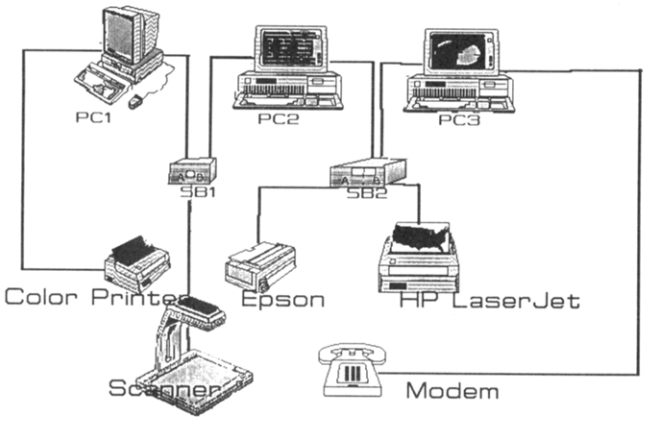

Figure 2. Work station configuration.

cards, a laser printer, a scanner, and modem are shown. All components of the system are networked together by two switch boxes. The scanner has proved invaluable to digitizing spectra, diagrams, and tables. These images are saved as .pcx files and brought into the StoryBoard environment, where lines are cleaned up and color is added. IBM StoryBoard software has been effectively utilized to build a library of some 800 computer slides. The software provides an integrated package of picture drawing, scanner retrieval, and sophisticated picture showing capabilities.

As approximately 20 people use our system each semester, we had to develop a method of organizing the hard disks that is easy to use. A directory tree is shown in Figure 3. All major software packages have their own directory. Within the StoryBoard directory, the Principles of Chemistry course files are contained in a subdirectory. The course directories are organized according to the chapters of the textbook, and the picture files are numbered in the order they are to be presented. Each .pic file represents a segment of the lecture slide. A stand-alone story file which specifies the way each computer slide is displayed is included in the chapter subdirectory. This method of organizing the hard disk, together with regular backup of archived slides, has provided a simple solution to the problem of storing and retrieving large and complex libraries of material for lecture presentation.

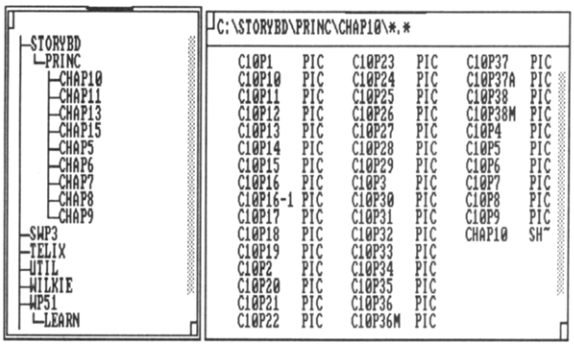

Figure 3. Directory tree for lecture slides.

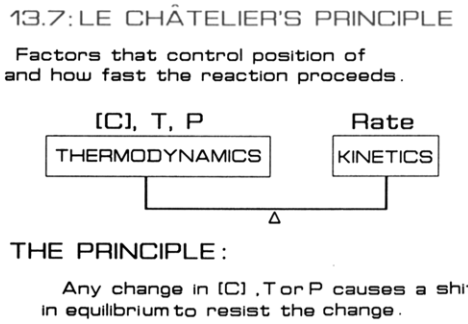

Figure 4. Typical lecture slide.

As previously indicated, visualization of the concepts is of utmost importance when the concepts of chemistry are being taught. While using existing software, such as Comprehensive Chemistry Curriculum for video disk,[3] live lecture demonstrations and VCR tape sequencing, is important to our curriculum development, the main thrust of our lecture lies with the use of the computer generated slides.

The enhancement afforded to our curriculum becomes obvious when you examine a typical lecture slide. Figure 4 is a lecture slide which is used when we discuss Le Chatelier's Principle. When keeping in mind our goal of increased visualization, you can see where projections such as this can be extremely useful to any instructor of chemistry. When the lecture and slides are supplemented with demonstrations and video, students can truly "experience" the concepts of chemistry.

CONCLUSION

Our success so far in involving graduate student assistants, recruiting top-notch undergraduates for software development, and gaining student approval of the lecture enhancements has provided assurance that system use will continue to be appreciated by students and lecturer's. Use of this system, demonstration preparation, slide review and modification, and the smooth coordination of video transitions require a special dedication to the art of teaching. Perhaps the greatest benefit of changing the medium of lecture presentations has been the renewal of teacher dedication to traditional goals of thorough preparation, demonstration use,[4] and training of teaching assistants for meaningful lecture assignments. If student response is considered, our initial goal of sparking student interest in chemistry through use of visualization[5] has been met by increased attendance and a marked decrease in that intangible quantity, student apathy.

ACKNOWLEDGMENT

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