

A COMPUTER INTEGRATED BIOLOGY LABORATORY EXPERIENCE

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ABSTRACT

There is a wealth of biology related material on the web. At Roane State Community College, we have placed computers on each student's biology lab table to be shared by two students. Each lab exercise includes web sites that enhance the laboratory experience. The CD-ROM that is included with their textbook is also available for use when it relates to their lab experience. Several other CD-ROMs are also incorporated as a part of the weekly lab exercise. This truly connects the biology laboratory experience to the latest technologies.

BACKGROUND

Roane State is a rural community college serving nine counties in East Tennessee. We started in 1971 with one main campus in Roane County located in Harriman, Tennessee. Now Roane State has two main campuses with the other campus located in the city of Oak Ridge. In addition to these two campuses, there are five other centers where we offer classes. Presently there are two biology labs on the Roane County and Oak Ridge campuses along with one lab in Cumberland County, and a lab soon to be placed at the Scott County facility. This will give Roane State a total of six fully equipped biology laboratories at four locations.

On the Roane county campus, we have begun to include computers as an integral part of each general biology laboratory exercise. In the past, we had a math-science computer lab down the hallway that was used as part of our lab and lecture classes. We reached the time that this computer lab needed to be extensively upgraded so we could offer web and CD-ROM capabilities at each terminal. With the onset of the student technology fee, it became possible to purchase computers to be placed in the biology lab where they would no longer be separate from the lab experience.

The present multimedia uses of technology in our lab consist of the following: A pair of TV monitors located near the ceiling are connected to a laser disk player, a color camera attached to the instructors microscope, and to the audio visual center. A second laser disk player is connected to a large presentation monitor on an elevated cart. An overhead

projector for transparencies placed in the center of the lab uses an 8'X 8' screen. We plan to continue using each of these along with computers. We have also received another presentation monitor which is connected to the instructor's computer. This monitor is used to show the students single images from a particular site.

DESIGN CONSIDERATIONS

It was felt that there was a good possibility we could use our existing general biology lab classroom without any major alterations. Each lab accommodates 24 students seated at six tables. The student tables are 42" X 60". Two students sit on each side facing the other side. There is a cabinet under the table located on both sides between each pair of students. These were used originally for the temporary storage of two microscopes each. When deciding how to best place the computer towers, it seemed like these cabinets were the logical location since the tabletops could not comfortably accommodate them. The computer monitors would need to be raised about six inches to place them at a more comfortable eye level. To accomplish this, we ordered tables 18' X 48" to be placed in the center of each lab table. The legs were cutoff for the appropriate height of about seven inches. One added benefit of having these tables was that there was a convenient out of the way place for the keyboard and mouse when not being used. Two monitors were placed toward the center of these tables facing opposite directions. This arrangement permitted the comfortable use of a computer by each pair of students. This also allowed ample table space for their lab manuals, microscopes, etc. Holes were drilled in the center of each lab table so the monitor, keyboard, and mouse cables were conveniently out of the way. The computers were connected to an expanded power source at each table. Connection to the Internet was brought down from the ceiling at three locations to serve each pair of student tables.

LAB SETUP PROCEDURES BEFORE CLASS

To avoid unnecessary problems during lab, the following steps are taken. The computers are turned on before the first lab of the week and turned off after the last lab. Our computers are set to automatically logoff after one hour when they are not being used. If CDs are to be used, they are placed in the drive before the students arrive. We use only one CD per class to avoid all of the problems dealing with multiple CDs. We do not use a server at this time. There is no reason for any student to touch the computer towers during lab. As a matter of fact, we would prefer for the student to forget about that part of the computer. The mouse and keyboard are all the students need to handle. We have one standard logon for all students and this is the only time they touch the keyboard. For each web site that is used during lab, we have entered the URL and saved it as a "Favorite" in the computer menu bar. This eliminates the arduous task of typing complex and lengthy codes. The mouse is used to navigate through each lab exercise.

THE LABORATORY SETTING DURING CLASS

To increase student interaction, we decided to let two students share a computer at their lab table, so it would be readily available as they were using their individual microscopes

or doing other lab exercises. It seems to work better when we supply the students with a handout sheet with detailed connections between the computer and their lab manual. Generally several questions are asked about the material being presented to ensure that the students are truly using the web. Since our biology lab accommodates 24 students, it simplifies our role as we float around the lab having to check only 12 monitors. When small problems arise, usually the students working together can solve their own problems. We are pleased to see the students spending more time in lab. Since many colleges and universities have their individual labs on-line, it is exciting to be able to show our students what other general biology students are experiencing during their labs. With the wealth of exceptional pictures of microscopic specimens, the students can compare what they are seeing through their microscope with a similar picture on their monitor. Many times the magnification for each specimen on their monitor is far greater than we are capable of getting with our light microscopes. When we find images captured with an electron microscope, it gives the students an added advantage not possible before.

COST INVOLVED IN SETTING UP THE LAB

The money to pay for the incorporation of computers into the biology lab came from the student technology access fee. Presently students pay \$8.00 per credit hour or \$62.50 maximum for eight or more credit hours per semester.

12 Dell computers for student use @ \$1,250 each: \$15,000.00
1 Dell computer for the instructor @ 1,250 each: \$ 1,250.00
1 Printer: \$330.00
6 tables for monitors @ \$80 each: \$480.00
24 sets of head phones @ \$2,00 each: \$48.00
Complete setup and wiring - no charge: \$0.00
13 CDs Interactive Study Partner for Biology - no charge: \$0.00
1 Presentation monitor connected to instructors computer: \$0.00
Total: \$17,100.00

We have purchased several sets of CD-ROM presentations in Lab Packs of 15 disks from Cyber Ed Inc. in Paradise, CA. These supplement areas in our lab where we have not found sufficient material in the format we desire and it gives variety to our lab exercises. These disks average about \$50 each.

A SUMMARY OF STUDENT EVALUATIONS TOWARD THIS LAB EXPERIENCE

We sampled our students from two perspectives. First, we were interested in their computer background and if they have a computer at home connected to the Internet. Being a rural community college, we were pleased that 86% of our biology students had a computer at home connected to the Internet. Fifty percent of our students connect to the web more than six times per week. Thirty-eight percent use a computer at work. We also found out 50% have used a computer as part of another class such as: Comp I, Orientation, U. S. History, Western Civilization, Introductory Algebra, Spanish, Art, and

Engineering. Only 50 % of our students regularly use the computer labs on campus. It was encouraging that 85% of the students use E-mail regularly. We were disappointed to find only 7% access the Roane State Home Page regularly and only 25% used the CD included in their textbook. Out of 82 students that responded to our survey only two try to avoid the computer if at all possible.

Second, we were interested in their input about how computers were being used as part of their biology lab experience. We generally received a positive response for all questions. Practically all the students enjoyed having the computer as another tool for their use in lab. We received a negative response from 1 - 4 students on most of the questions on this part. We were very pleased that 79 students did not see a problem with two students sharing a computer. Seventy-eight students found the protozoan 3-D images to be beneficial, especially for volvox and spirogyra. Since all students keep copies of the lab exercises, we were pleased that about 50% accessed several of the web sites on their own after class. We used the prepared questions in the computer exercises whenever possible. The students checked their answers. The Biology Project from the University of Arizona supplies a tutorial for each question. Students are presented background information about the question asked which is very beneficial whether the question was answered correctly or not.

SETTING NEW GOALS

With the incorporation of computers into the laboratory experience, we can see an unlimited potential far into the future. We hope to develop a realization within our students as to the usefulness of computers in every aspect of biology. This is the beginning of our quest for an on-line lab component to our biology program.
