A MULTI-PURPOSE COMPUTER LAB FOR A SMALL COLLEGE

Darrah Chavey  
Dept. of Computer Science  
Beloit College  
700 College Street  
Beloit, Wisc. 53511  
(608)-363-2220  
chavey@beloit.edu

Support for this work was provided in part by NSF IWI Grant #USE-9151985.

Small colleges face problems in constructing computer labs that are not shared by larger institutions. Due to moderate usage, it can be difficult to justify a large computer lab used for a restricted purpose, e.g. departmental labs. When only a few classes will use "high technology" presentations, it is difficult to justify equipping a "master classroom," at least until sufficient interest is generated to leverage that construction. With smaller student bodies it becomes difficult to arrange non-credit "computer training" courses that reach enough students simultaneously. Our solution is to use the same laboratory space for several uses. Our lab is designed for, and primarily intended for, introductory computer science classes. Lab sections of CS courses are taught there several afternoons each week, with extensive use of a computer projection system. Student use for these (and other) courses is heavy during evenings. The room is used by other courses for presentations during morning and afternoon hours, e.g. for a course on "Computer Applications in Geology," and for freshmen seminars. The projection equipped computer is installed on a mobile cart and is taken to other classrooms for presentations. Self-training software has been installed so students can learn to use computers, and most installed software, at their own pace.

OVERVIEW

Problems Faced at Small Schools:

Small colleges face certain problems not shared by larger universities. For example:

1. Due to moderate usage, it can be difficult to justify a large computer lab for a single department. A small departmental lab can be justified, but is insufficient for classroom presentations.

2. When only a few classes will use "high technology" presentations, it is difficult to justify equipping a "master classroom," at least until sufficient interest is generated to leverage that construction. But how can a small school leverage interest in a multimedia classroom? The cost of one such classroom is prohibitively expensive for a small school unless you can demonstrate that you'll generate major use of that room.

3. Students interested in specific "high-tech" subjects may have need for certain specialized equipment, such as color scanners, printers, and multimedia equipment. Nevertheless, a small school cannot afford labs specialized for such purposes, nor "lab attendants" who monitor excessive use of such resources (especially color and laser printers).

4. With smaller student bodies it becomes difficult to arrange non-credit "computer training" courses that reach enough students simultaneously.

5. Small student bodies also make it difficult to staff "help desks". While a wonderful user oriented service, this is used too infrequently at a school such as ours to justify full-time staffing to support it.

Nevertheless, on each point, small schools still need (or should try) to offer some scaled down version of these services. For example, many departments have 1 or 2 classes that could make great use of a computer lab. Many faculty are willing to experiment with using multimedia, but first need support, such as a classroom, in which to learn how to use it. Students still need help in learning software, the type of help they would get from non-credit classes or a helpdesk, but the total mass of help needed is much less than at a large school.

To put this in perspective, imagine a large university with 30,000 students and 200 staff members in computing services. The equivalent at our 1,000 student college is 7 staff. If the university puts 5 staff members into student user support, then our college equivalent is 1 person working 1/6th time, hence you can guaranteeing that this person will not be available when the student needs it.

Solution

The obvious solution to this problem is to use a single computer lab to serve several simultaneous purposes. This is feasible at a small school because no single use of that lab will demand all of its resources. Care must be taken to co-ordinate competing demands...
on such a lab. If one particular use of the lab begins to dominate, that should justify additional resources devoted to that use. "Help desk" facilities are, at least in our case, not fundable, and so alternatives must be found. We have settled on self-guided tutorials, freshman seminar presentations, and help through the college tutoring services.

Background

Beloit College currently has 15 computer labs, with nearly 100 computers, for a student population of 1000. We have added at least one new lab each year since 1985. Most of these labs are small, e.g. a departmental lab of a few machines with software specific for that department. These labs are generally too small to use for a class, either for presentation or hands-on work. While these labs serve many of our College needs, the limited size and scope of these labs kept them from solving the problems outlined above. We built our lab principally to allow us to teach closed lab sections of computer science courses, but realized we could also use this lab at other times to meet these additional College needs. We feel that this arrangement can be used to satisfy similar problems at other small schools.

Paper Outline

We give a survey of our lab and the way it is used for these varied purposes. This is followed by more detail on the implementation of the specific lab functions. The emphasis in this paper is to give pointers to a variety of solutions we have used to the problems confronting us in this endeavor. Contact the author, or follow the pointers, for further details on individual solutions. For a general reference on building a computer lab, we strongly recommend "Creating and Managing an Academic Computing Lab" (Apple [1991]), even for non-Macintosh labs. This booklet includes sections on planning, layout, managing lab consultants, etc. Apple no longer distributes this booklet, but interested readers can get a copy from the author.

LAB OVERVIEW

We built a single multi-purpose, ethernet connected Macintosh lab (14 Mac IIIs, plus 3 other Mac's), but most of the issues and solutions discussed here transfer to labs of IBM clones or UNIX machines. Faculty can reserve this lab for course presentations, but rarely for regular courses all semester. These reservations are primarily scheduled during morning and early afternoon time slots. The computer science program uses the lab 2-3 afternoons a week for labs. Other afternoons and evenings, the lab is used for CS programming assignments and for open student access. The lab is equipped with multimedia presentation equipment. This equipment is mounted in a "Mobile Multimedia Cart." This cart is easily delivered to other classrooms for use in those classes, and classes that only need computer presentation (not hands-on student use) are encouraged to use this mode to keep the lab open for student use. Faculty can take the multimedia cart to their offices to develop presentations in privacy, and has been used by students for term project presentations. Single instances of high-end equipment (multimedia equipment, scanners, color printers, laser printers, and some software) are networked and can be accessed from any lab computer (one at a time, of course). We developed on-line tutorials for the lab, which introduce students to the software and hardware, and from which students can select tutorials on individual programs, or specific advanced features of certain programs. We give one hour presentations to students in many of our "First-Year Initiative" classes, which all incoming freshmen take. These presentations introduce them to some tools and to the collection of tutorials. This is usually followed by another 1-hour session in which the students work through tutorials of their choice.

COURSE USE VS. OPEN STUDENT USE

Our computer lab was 50% funded by the NSF Instrumentation and Laboratory Improvement program for use as a closed laboratory for the introductory computer science courses. For this reason, and because of clear needs by the CS department for such a lab, it is vital that this room be reservable for such lab sections, and closed to other students during this time. However, CS classes reserve use of this room only about 8 hours per week. To maximize use of the equipment, we have open student access at other times, and have made the lab reservable for other classes. Reservations have been used mostly by faculty in the sciences (who share a common building), but also by other faculty. Reservation requests must be turned in the week ahead, reservation times for the week are posted each Monday, and we are experimenting with software to notify students in the lab 1.5 minutes before a class reservation is scheduled to begin.

The major resource balancing problem is between competing uses for courses and for individual student use. Students primarily use the lab for individual work during evening hours or late afternoon. Classes that use the lab are primarily morning, or early afternoons. Still, we have begun to get many reservation requests, and consequently complaints from students that they are closed out from the programming (and word processing) time that they need. We have taken, or are implementing, several steps to reduce these conflicts. We wish to do this by increasing efficient use of the resources, however, and not by restricting either class use or individual student use of the resources. Steps taken to improve this resource coordination are:

- We encourage course instructors to make occasional use of the lab for those lectures that will require its use, but not to make continuing reservations without special cause (and special permission). Courses that have used the lab regularly include the computer science labs, statistics, astronomy, and a half-term course on "Computer Applications in Geology."

- Since the multimedia cart (with the projection system) is mobile, we encourage instructors to have the cart delivered to their regular class room if they only need projection. Lab reservations are limited to courses that need hands-on student use.

- Courses that expect to make regular use of the lab are encouraged to be scheduled earlier in the day (before 2:00 P.M.) so that their use does not conflict with the times when individual student use demands are at a maximum. Evening reservation times are especially restricted. Our CS 1 labs used to be scheduled during evenings; they are now scheduled for afternoons (1:00-4:00 P.M.). The only evening reservation currently allowed is for an Astronomy lab, held about half of the time in this lab.

- Games and similar "frivolous" uses are permitted, but only while other machines are free. A startup screen warns stu-
students that use of the machines for games, MUD, or IRC are prohibited unless at least one other machine is open for any new arrivee. A UNIX script regularly "pings" the lab machines to see if they are all in use, and if so notifies me and a lab assistant, allowing spot-checks to see if students are abusing this requirement (my office is very close to the lab).

- Since student programming for CS courses is a primary consumer of open lab time, we try to co-ordinate program due dates with reserved blocks of time to prevent large reservations during the 1-2 days before a major program assignment is due.

GENERAL LAB SETUP

Keeping all computers the same is a standard lab problem, but one that has standard solutions. We use FileGuard to control access to certain system software, to prevent students from booting from a floppy, and to prevent students from removing RevRDist or RevRHelper. RevRDist ensures that each lab hard disk is the same as a "master image" hard disk image established on a file server, updates all hard drives when we add files to the master image hard drive, and removes files left by students (these are kept for 24 hours in case of student error, then deleted). See Miller [1993] for more details on RevRDist. RevRHelper is used to reset the PRAM settings (such as sound, cache size, etc.) to our preferred settings. KeyServer is used to guarantee that software use complies with our license agreements, and prevents students from making unauthorized copies of licensed software. It also tells us when we need additional licenses, based on "requests" for software use. Disinfectant Init is used to prevent viruses. This software is available as follows:

RevRDist: (Freeware) ftp://ftp.cc.purdue.edu/pub/mac
RevRHelper: (Freeware) ftp://ftp.cc.purdue.edu/pub/mac/testing
KeyServer: (Buyware) email://sassafras@dartmouth.edu
Disinfectant: (Freeware) ftp://ftp.acns.nwu.edu/pub/disinfectant

For hardware security, computers and monitors are chained to the tables by security bolts in the back. We have not found it necessary to implement more serious security measures such as those described in Baker [1993]. Since this lab is open late at night, we are considering some of the steps suggested by Walter [1993] to safeguard the security of users, e.g. single women working late at night.

MOBILE MULTIMEDIA CART

The lab, as originally designed, included a high quality screen projection system for demonstration purposes. Two problems arose with this system:

- In some cases this room was inappropriate for demonstrations, due to large class size, lack of other materials, or the co-ordination of redirecting a class to this room.

- Using this room only for computer presentation, when no hands-on use by students was needed, locked up lab resources unnecessarily.

Our solution was to construct a "Mobile Multimedia Cart" on which this projection equipment is mounted. This allows a faculty member to take this equipment to their classroom (or lab) for presentations or to their office to develop presentations. (Students have also used it for presentation of term projects.) The use of this cart has encouraged us to include significant additional hardware for this station appropriate to multimedia presentation work. Our cart is based on the presentation by Schneebeck & Zweier [1993] on the mobile multimedia cart developed at California State University, Long Beach by them and Apple Computer (see figure 1). Their cart includes a Mac Centris 650, Dukane high lightflow heat projector, color LCD projector screen, external speakers, CD Drive, Syquest cartridge, VCR player, LaserDisk player, and sound mixer. We have not (yet) included all of the multimedia equipment recommended by the designers, but have added a drawer to hold manuals and remote control devices, and used a 24-bit color projection panel. We added a 10BaseT ethernet connector to the cart, installed 10BaseT ports in several classrooms, and expect to add ports to several other classrooms. This allows the cart to be easily connected to the campus network, and hence to the Internet, for access to file servers and for demonstrating Internet tools and techniques. 10BaseT connectors allow the cart to be easily plugged or unplugged without disrupting the network.

The multimedia cart remains in the lab when not in use elsewhere. The cart closes into a solid box, and is not available for "open" student use. Science faculty have keys, as do students with demonstrated need for this equipment (the equipment is, of course, physically bolted to the cart). Access is restricted primarily to prevent unnecessary use of this machine in preference to the others, and hence to keep this machine more available for its intended purposes.

As with Schneebeck & Zweier, we do not necessarily prefer one hardware platform (i.e. Mac or Windows) over the other, but strongly recommend that schools contemplating such an endeavor begin by supporting one platform, and expanding if demand justifies it.

HIGH END EQUIPMENT

Most uses of the lab, both by classes and by students, are for software from a small set of common applications. Occasionally students (or faculty) wish to use high-end software or hardware that we cannot justify purchasing for all computers. To overcome this, we have used several separate solutions:

- We use KeyServer to allow us to purchase a few licenses of some software packages while guaranteeing that no more than the legal number of copies run at once.

- Less commonly used software is kept on a central file server, with aliases to that software (part of Macintosh System 7) kept on each lab machine so that students get transparent access to it. This makes each local hard disk have "virtual size" equal to that of the file server, allowing us to make much more software available. (A public domain software collection is also maintained on this server with easy lab access.)

- As mentioned above, key access is used for the principal multimedia machine.

- Two lab machines (Centris 650's) have built in CD's for student use. A Panasonic 6 CD jukebox is networked to allow faculty to share CD's they want students to have access to.
This is appropriate for CD's that will be used "occasionally", but becomes a heavy load for an "often-accessed" CD. In the spirit of the lab, any CD that demonstrates such demand is expected to be placed on a dedicated CD player.

- A color scanner, color printer, and laserwriter are attached to a single high-end Macintosh. Earlier setups of this style resulted in students using that machine for work unrelated to the equipment attached to it, since it has extra memory for the graphics software, and this interfered with its use for the desired purposes. A startup screen now informs the user that this machine is to be used just for scanning, image processing, and color printing. We now use FileGuard to forbid use of most word processors and compilers, and to require students to re-enter a (public) password every 15 minutes. This has been just enough incentive to use other machines that this machine has remained available for students needing this equipment. For example, in order for students to print a word processed document onto the laser printer, they must first save it to a postscript file, copy that output to a disk, take the disk to that machine, and use LaserWriter Utility to print the postscript file. Because of the cost of these printers, we are considering installing "printer change-back" software, which electronically hides these printers from the student without a special disk (Laser DiskCharge, from d.cox@uts.edu.au). Students purchase, or "fill up", these disks from a secretary or computer services, and that disk gives them access to an account stored on the print server allowing the laser printing and debiting their account when they print.

Figure 1: The Multimedia Cart [Schneebach & Zweier, 1993]

SELF-GUIDED COMPUTER LITERACY LEARNING

When we designed our lab, we intended it partially for closed labs in a "Computer Literacy" course. As incoming students have become more computer literate, this course has generated less interest, and no longer seems the right way to teach computer skills to our students. Students still need to learn new skills, but want more "need-based" training, e.g. the day before their paper is due. We have not been successful at training sessions for specific software (with the exception of email tutorials), because they generally are not available when the student suddenly perceives the need. Still, we wanted to use this lab to help students learn the use of various software. To do this, we have implemented several solutions:

- When the computer is turned on, a startup "Tutorial" application is run. A student can exit by typing <Return>, or can choose from several tutorials. (They can also launch this tutorial later if so desired.) These tutorials include the general "Learning the Macintosh" tutorial provided by Apple, tutorials provided by some software companies, and tutorials written by us. For student use, it is vital that tutorials be broken into topical pieces, easily indexed. For example, a student generally does not want a full "Microsoft Word" tutorial; they may want an introduction, to learn footnotes, the grammar checker, etc. They must be able to easily find help for their current need, especially since we do not have a Help Desk. The tutorials are arranged hierarchically so a student can choose "Word Processing", "Internet Tools", "Graphics", etc., then pick introductions or specific topics within those categories. This tutorial also advises the students of the availability of video tapes and manuals for that software. We hope to present a more detailed paper on this tutorial system to the ACM SIGUCCS conference in 1996.

- Video Tape tutorials for many software packages are available, sometimes from the software vendor, and sometimes from professional training organizations (e.g. MacAcademy). We have several such tapes available for viewing in the library. We do not expect the tapes to be used frequently since students rarely want the full depth of treatment offered by these tapes (e.g. 9 hours of training in Excel!). Some tapes give extremely good surveys of the software capabilities (e.g. those provided by Animation Works and Swivel 3D), and the tutorial application particularly recommends these. The other tapes are available for those occasional students (or staff) who want more complete training, but are especially used by our student workers who are developing the smaller topic oriented tutorials for this tutorial collection.

- Manuals for the more common applications are kept in the lab. When we have multiple copies of the manuals, we leave them unsecured, with others secured to reading tables in the lab. Manuals for less often used applications are kept in the library, and references to them are mentioned in the tutorial application.

- Since this lab is maintained by the CS department, we have named each of the machines after famous individuals from the history of computing. Just for fun (and hoping to teach a little computer history), the lab tutorials offer the student the option of reading a short biography of the individual that machine is named after.

FORMAL TRAINING CLASSES

In the previous section, we described techniques for self-guided learning. The lab is also used for more formal training. This is often done by individual professors teaching software for their courses. To aid this effort, we hold an "open house" each semester to show instructors techniques for using the lab effectively. One vital feature is to use Timbuktu to "lock out" all monitors in the room (e.g., to prevent students from reading email during lecture) or to use Timbuktu to project their screen to each student station (an alternative to projecting to a screen).

One "general" training we do is aimed at our "First Year Initiative" courses; inter-disciplinary courses restricted to freshmen and taught by the students' advisor. These courses are intended to aid students in learning college skills, e.g. library skills, study skills, re-writing, etc. Consequently, this is an excellent vehicle for communicating computer skills to new students. We give a 1-hour overview of the different types of software available (graphics, spreadsheets, Internet, presentation, etc.), show the structure of the tutorial application, and then give the students one hour to work with the tutorials. For the computer novice, they can run the Macintosh tutorial, while more knowledgeable students can learn a new program. In either case, we hope the students will know what software is available to them and will feel comfortable returning to the lab to learn those skills when they need them.

The "Learning Resource Center" (our college tutoring service)
aids in presenting the basic computer literacy workshops to the freshman seminar groups, including the demonstrations of the available on-line tutorials. They offer tutoring throughout the year in basic software use, and this co-ordination aids their tutors in knowing when they can refer students to these tutorials, and when one-on-one instruction is more appropriate.

CONCLUSION AND RECOMMENDATIONS

At a small school, we do not want large "cavernous" computer labs or terminal rooms as sometimes found at large institutions. However, it is extremely useful to have a lab large enough to accommodate a normal size class. Faculty and students should have easy access to the opportunity to try new things, and resources to help them learn the necessary software, hardware, or presentation techniques. With some planning, it is possible to build and co-ordinate a multi-purpose lab so that it simultaneously meets several institutional needs. Such a room can be the catalyst to encourage a new major use of computer facilities, such as multimedia, campus-wide email, or computer use by specific departments. If a particular use of this general purpose lab begins to consume a significant amount of its resources, then this should be taken as sufficient grounds for adding new facilities specific to that use.

REFERENCES


CSULB's Mobile Multimedia Cart provides instructors with technology for multimedia development and classroom presentations. Uses of the cart include the presentation of dynamic or complex concepts by integrating selected video, pictures, sound, animation and text into a presentation. Through the mobility of the cart, technology is delivered to the users, bringing the power of interactive multimedia learning to any classroom.