

COMPUTING ACROSS CURRICULUM

EPICS program adopts NeXT *Colorado School of Mines*

The Engineering Practices Introductory Course Sequence (EPICS) is a four-semester interdisciplinary program at the Colorado School of Mines is one of the leading engineering education programs in the nation. Yet, in the late 1980s, faculty and administrators discovered that students were not completing the program with the computer skills required for their upper division courses.

“The theory behind the program had been to expose students to as many approaches to computing as possible—from hand-held calculators to personal computers to mainframes,” says Barbara Olds, director of EPICS. “But we found that students weren’t programming well enough for their upper-division courses because they had been exposed to a little bit of everything rather than learning a few applications very well.”

During the summer of 1990, EPICS faculty began to revise the curriculum, limiting the computer instruction to three main applications—Fortran, Autocad, and a spreadsheet. The program is gradually moving from MS-DOS to a NeXT workstation environment. Currently, NeXT machines are used heavily in instruction of the third-semester course, EP201, and the faculty is working toward implementing NeXT machines and applications, such as Diagram! and Lotus Improv in the second semester course, EP102.

According to Jacob Gore, assistant professor of mathematical and computer sciences, “There were several driving reasons for wanting to move to a workstation environment. First, we wanted to familiarize students with appropriate technology. PCs are outdated and have lost ground to workstations in the engineering workplace. In addition, single-user machines, like MS-DOS and Macs, are prone to virus attacks. Students enrolled in the spring semester of EP102 spent up to a third of lab time recovering from virus attacks and attempting to pre-empt them. Many students had to redo several assignments because of lost data.

“Plus, EPICS computer courses were going through far too much paper. Too often, assignments got lost in the flood of paper between the students and the graders. This was costly, unprofessional, and unfriendly to the environment. Workstations, like NeXT, make paperless classes possible.”

Gore says that administration of the Ethernet network is also simpler and more cost effective. “We need an

environment where the administrators can concentrate on keeping things running smoothly and not waste time on rebuilding systems or restoring locked networks," he says. "The NeXT workstations are designed for multi-user use. The network they use is very robust—robust enough to operate over national and international, noisy telephone lines. In addition, the NeXT workstations deal gracefully with temporary losses of access to the server, typically without any loss of users' work."

In EP201, students are introduced to engineering problem-solving using NeXT computers. As a "real life component" to the course, students work in teams of three or four to develop computer-based solutions to problems. Last semester, for example, one group worked on filtering and linear regression parsing of samples of electric current drawn by mining equipment during a work shift. The line segments this project produces serve as input to artificial intelligence software that tries to recognize what the monitored equipment is up to during the shift.

Gore and Bob Cameron, associate professor of mining engineering, who team-teach EP201, also instruct students on problem-solving with Fortran. They use Absoft's object-oriented Fortran 77 compiler and the freely available F2C Fortran to C translator and typically present a Fortran construct during each class period, assign up to three exercises to reinforce the constructs and provide assistance as students perform the exercises.

With a Diagram! palette of flowchart symbols developed by Gore, students create flowcharts for their program designs. "Diagram! has been a big help," says Gore. "Students usually hate creating flowcharts, but this application has made it enjoyable for many of them."

Students use NeXTmail to communicate with one another and Gore, who posts syllabi, homework assignments, course materials, and announcements electronically to the local Usenet group. Students must submit all homework and project materials through electronic mail; paper is not accepted for grading.

Graders use Redmark, an on-screen review and redlining application, to correct all assignments. According to Gore, "Redmark has cut grading time by 70 percent. Graders can now just scribble their remarks on an image of the homework. In addition, everything the students mail is now automatically archived on the NeXT, which has brought the number of lost homework assignments to zero."

Besides EPICS, the CSM Mathematics and Computer Sciences Department uses 25 NeXT machines with *Mathematica* in their freshman and sophomore calculus classes.

"The NeXT lab provides an impetus for us to think about how calculus should be taught," says Professor Frank Hagin. "We've decided to place less emphasis on marginal topics that will rarely be used. We make good use of *Mathematica* Notebooks—which are basically self-contained teaching units—and have students

work through the Notebooks as laboratory assignments.°

Says Hagin, "You get a lot of bang for your buck with NeXT. The bundled apps provide us with everything we need to teach calculus. NeXT is a bargain compared to a well-equipped Macintosh. And it has a very elegant and powerful software system that we think represents where computing systems are headed in the future.°

According to Derek Wilson, director of the CSM computing center, NeXT machines are also used as productivity tools by 40 CSM administrators and faculty members.

"With NeXT, you have the functionality of a PC with the power of a workstation," he says. "The critical apps are straight forward and completely usable. And it's great that we can run multiple apps at the same time. Because of this, the NeXT has had a significant impact on the way we work at CSM. For example, I used to have information scattered around in a variety of paper files. When I'd get a call about the status of a project, I always had to get back to the person later because I needed time to sort through my paper to get the information. With NeXT, though, I might be running Digital Librarian, Lotus Improv, and DataPhile at the same time so it's easy to just pull up the information immediately and access it on the spot for them.°

He adds, "It's terrific that students have access to all sorts of applications that come bundled with the NeXT. The apps combined with multitasking capabilities make NeXT a much more productive learning environment for students.°

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