Information Technology

On Line

Three governors who champion the use of technology in education practiced what they preach last week. They used audio and video signals delivered by satellite and telephone lines to talk with more than 200 distance-learning professionals meeting near Washington.

Technology makes available to rural parts of Iowa and other states "the best educational opportunities in the world," said Iowa Gov. Terry Branstad, a Republican.

Iowa has invested $170-million to create a statewide fiber-optic network. Rural schools can receive advanced courses from other schools or colleges over the network.

Frank Keating, the new Governor of Oklahoma, said his state was using technology so that students in farm communities can receive the same education as those in cities.

"Admissions officers don't care if they come from a town of a hundred or a town of one million," said Mr. Keating, a Republican.

Vermont's Gov. Howard Dean, a Democrat in another rural state, said he was advocating more state spending on technology because it provides opportunity and can ultimately save money.

"Without it we will surely fail in our mission to control costs in education," he said.

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The National Science Foundation has given the Los Alamos National Laboratory $1-million to expand an electronic collection of scientific abstracts.

Originally developed in 1991 as a repository for research on high-energy physics, the system now contains abstracts of papers on physics, mathematics, and economics.

The three-year N.S.F. grant is intended to expand the data base to cover all areas of physics and other fields in which users express interest. The money will also help Los Alamos improve the system by providing direct links to citations, images, data, and a system that allows for feedback from readers.

The archive is available on the Internet to users who have Mosaic, Netscape, or another World-Wide Web program. The Uniform Resource Locator is: http://xxx.lanl.gov.

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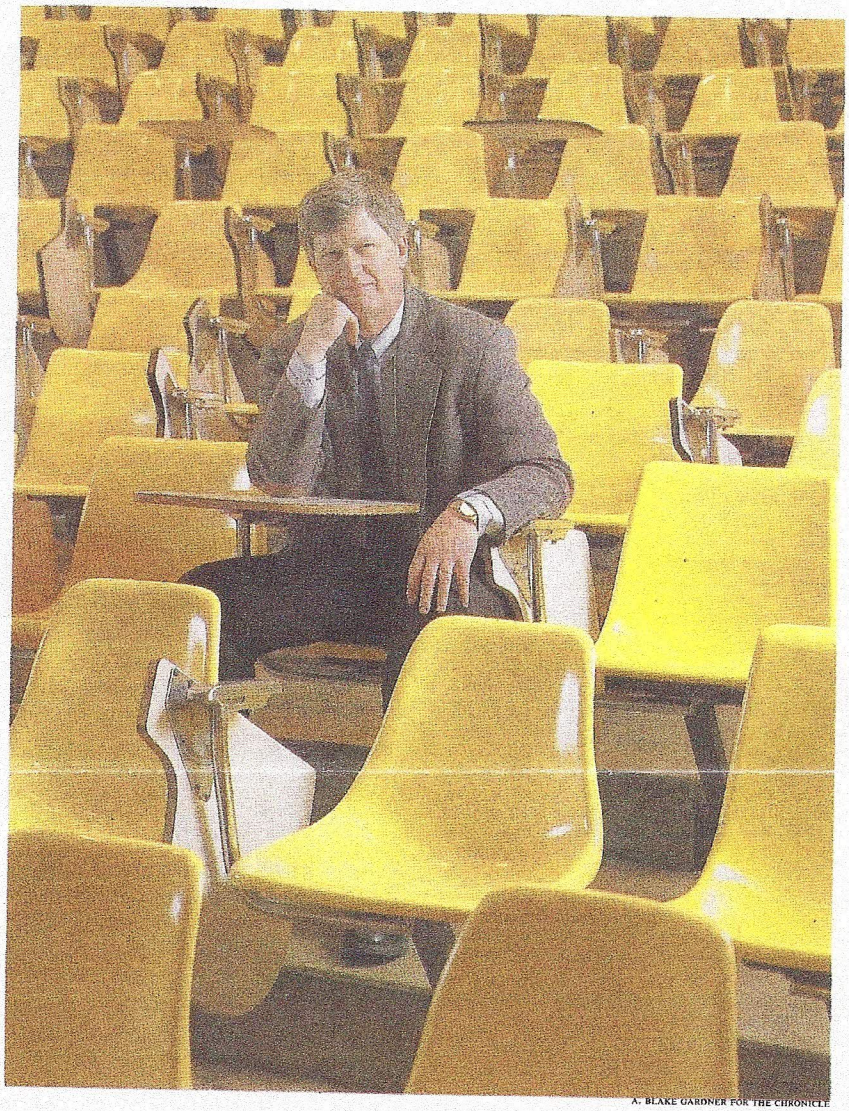
A new survey indicates that tomorrow's college students are not likely to have much experience in using information technology in the classroom when they arrive on campuses.

The survey, by the American Electronics Association's National Information Infrastructure Task Force, found that just 59 per cent of teachers surveyed said they had access to multimedia computers, 29 per cent had networked computers, and 20 per cent had an Internet connection.

Eighty-five per cent of school librarians had multimedia computers and half had Internet accounts.



Jack M. Wilson: "If we can identify savings, then we're glad to have them, especially if that means we can do some of the things that we want to do."

A. BLAKE GARDNER FOR THE CHRONICLE

'Studio' Classrooms

Rensselaer uses computers to replace large lectures in introductory courses

By Thomas J. DeLoughry

TROY, N.Y.

JACK M. WILSON makes an unscheduled stop as he crosses the campus of Rensselaer Polytechnic Institute. He wants to demonstrate the wrong way to use computers in the classroom.

He ducks into the rear of a half-empty lecture hall, where an unsuspecting professor stands next to a computer at the front of the room. Images flash on the screen above the instructor while reclining students glance upward, some scribbling notes.

This, Mr. Wilson says, is "the horseless-carriage model." Rensselaer, like many other universities, has added new technology to old teaching methods without thinking about how things could be done differently.

The next stop is what Mr. Wilson wants to show off: Pairs of students working in front of computer screens, engaged in what they are doing, participating in a class of about 50 that enables them to discuss ideas with the whole group or with instructors roaming around the room.

Introductory physics is now taught this way here, as are some calculus, biology, and engineering classes. Introductory chemistry is expected to adopt these methods in the fall of 1996.

HIGH RATINGS FROM STUDENTS

Students give the new "studio" classes higher approval ratings than they gave traditional lectures in the past. Professors say the new methods have caused them to think more about their teaching. They are delighted to hear students ask questions that are more thoughtful than any asked in lectures.

If student and faculty satisfaction were not reason enough to support widespread use of the studio methods, officials here offer another: The smaller, computer-assisted classes cost the institute less than traditional courses that feature large lectures, discussion groups, and laboratory sessions.

Across higher education, all of those attributes have helped to attract the attention of administrators and faculty members who are hungry to find ways to improve instruction and use technology more productively, without drastically increasing costs.

More than 60 visitors have been here in the last two years to see the studio classes firsthand. The College of St. Catherine and Dickinson College have similar programs, California Polytechnic State University at San Luis Obispo is testing the idea, and the

Continued on Following Page

Rensselaer Uses 'Studio' Classrooms to Revamp Introductory Courses

Continued From Preceding Page

U.S. Air Force Academy is modifying its physics curriculum for the fall semester.

"It's both high-tech and high-touch," says K. Patricia Cross, a professor of education at the University of California at Berkeley. She gives Rensselaer high grades for replacing large, impersonal lectures with sessions that provide more-personal contact and get students to learn on their own.

"I think the studio approach is going to transform all of those courses that everybody suffered through," says Elaine El-Khawas, vice-president for research at the American Council on Education.

Ms. Cross and Ms. El-Khawas were members of a judging panel that awarded Rensselaer the 1995 Hesburgh Award for Faculty Development to Enhance Undergraduate Teaching. The award is sponsored by Teachers Insurance and Annuity Association–College Retirement Equities Fund.

REDUCING CLASS SIZE

Mr. Wilson, a physics professor and Rensselaer's dean of undergraduate and continuing education, has presided over the studio experiments as the director of the institute's Center for Innovation in Undergraduate Education.

A typical two-hour session in studio physics, he says, starts with a review of readings and exercises that students have done on their own. The classes then progress to an experiment that might involve a motion detector attached to a computer to measure the velocity of a falling golf ball. The session often ends with a "mini-lecture," in which the professor summarizes what the students have learned and assigns homework.

Part of the appeal of the studio method is obvious: Reducing class size to 50 or 60 from 345 greatly increases the opportunity for interaction between instructors and students. But a bigger benefit, Mr. Wilson contends, is the hands-on approach, which requires students to work out solutions on their own without blindly copying down what the professor says.

Time is spent so efficiently, he says, that students need only four hours a week in introductory physics versus the five and half that were traditionally spent in lectures, discussion groups, and laboratories.

FEWER TEACHING ASSISTANTS

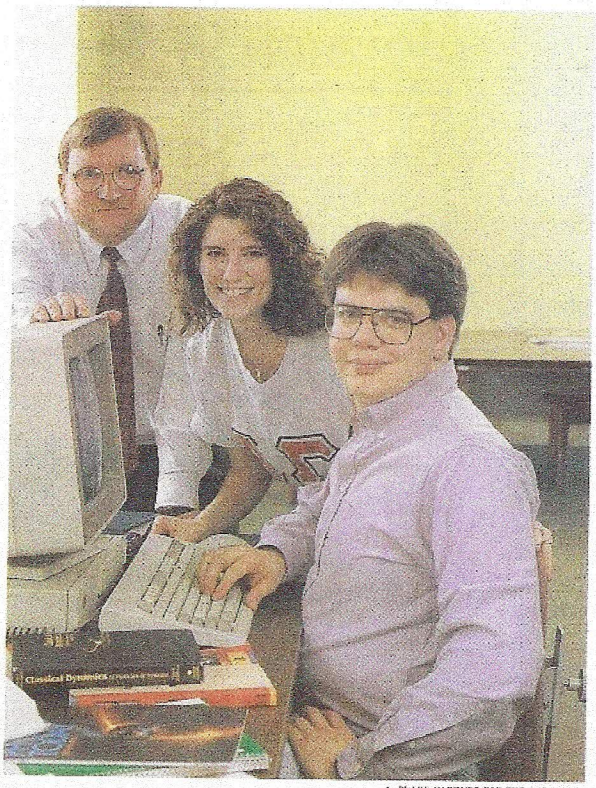
The reduction in class time produces a saving that Rensselaer officials estimate at $50,000 or more for large introductory classes. Most of it comes from the reduced demand for teaching assistants, who have been primarily responsible for the discussion groups and laboratories in the traditional introductory courses. The saving on personnel expenses, Mr. Wilson says, more than offsets the $100,000 cost of creating a studio classroom, if the costs are spread over five years.

The cost issue, though, is an uncomfortable one here. Mr. Wilson cites it to win over skeptics who believe that smaller classes have to be more expensive than large lectures. But he grows skittish about discussing finances in great detail and shares his analyses only on the grounds that they not be published.

He says he guards the cost estimates because he doesn't want the salaries of faculty members and teaching assistants to be made public. But administrators here also worry that the studio experiment will be viewed as a budget-shrinking exercise rather than as an attempt to improve instruction.

They have good reason for concern. Some faculty critics have linked the studio effort with a larger cost-cutting campaign at the institution. "There are a lot of agendas that are not being *officially* associated with this that *are* associated with this," says Jane Koretz, a professor of biophysics who is the president of Rensselaer's chapter of he American Association of University Professors.

Mr. Wilson denies such a charge and suggests that the money saved is only icing on the cake for an effort dedicated to improving instruction by eliminating large lectures. "If we can identify savings [illegible] then we're glad to have them, especially if that means we can do some of the things that we want to do," he says. The money saved in converting one physics class to the studio model has been used to plan changes in others, he notes.



A. BLAKE GARDNER FOR THE CHRONICLE

Wayne G. Roberge (left), with students: "Every day you do something that forces the students to use the concepts."

A COURSE AT DICKINSON

Rensselaer's studio arrangement is similar to a "workshop" physics course that Priscilla W. Laws has taught at Dickinson College since 1987. Hers is a smaller effort, which has involved revamping physics classes of only 75 students. Her class uses software developed for Apple Macintosh computers that allows students to conduct experiments by attaching temperature sensors, motion detectors, and other devices to the computers.

In 1993 Rensselaer tried out the studio model in a calculus class that used "Maple" software for exercises and problem solving. Mr. Wilson and Wayne G. Roberge taught the first physics class in the studio format last spring, using "CUPLE" software for I.B.M.-compatible computers that Mr. Wilson had developed with Edward F. Redish when they had taught at the University of Maryland at College Park.

Rensselaer's physics department rapidly expanded the experiment to accommodate all 400 students in the introductory class last fall. This spring the department has 300 students in the studio setting and 400 in the traditional lecture, because Rensselaer's five studio rooms are not sufficient to handle all 700.

The failure to provide the studio class to all students disappoints Mr. Wilson and other officials. The space crunch, though, is a benefit to Sister Marie A. Cooper, a doctoral student at Rutgers University who is studying the effectiveness of the studio method. For the first time, she has the opportunity to study the old and new methods side by side.

Officials here already know that students give the studios a higher approval rating than traditional courses. In addition, the students in the first studio physics class took the final examination in a traditional lecture class to demonstrate that they could do as well as those who attended class for an extra hour and a half each week.

EXPLORING CONCEPTS

Sister Marie intends to evaluate the approach more comprehensively. She has sat in on the studio classes, administered exams to the students, and met periodically with a group of students to monitor their performance on problem-solving exercises.

She does not yet have data on comprehension levels, but she believes that students benefit from having to explore concepts on their own. "I believe it gives the student the opportunity to learn rather than just repeat," she says. "They have the opportunity to take responsibility for their own learning and to learn as professionals."

Dickinson's Ms. Laws believes that students do learn better in a studio format, but she suggests that their support for it may never be unanimous, because some students are used to having teachers tell them the correct answers, and they grow frustrated when told to work out solutions on their own. "They're so used to learning things superficially," she says. "They've been rewarded for 12 to 16 years for using different strategies."

Faculty members at Rensselaer

Project Aims to Promote Discussions About Using Technology for Instruction

By Thomas J. DeLoughry

WASHINGTON

The American Association for Higher Education has launched a project aimed at getting college professors and administrators more involved in the use of technology.

The effort attracted about 275 people from 90 institutions to a meeting held in conjunction with the association's annual conference here last week. Provosts and librarians joined professors and computer-center personnel to discuss how they could work together to bring the benefits of technology to more classes on their campuses.

FOCUS ON TEACHING

The higher-education association traditionally has been interested in improving college teaching, and has become active in the technology realm only in the last year. Its new project, known as the Teaching, Learning, and Technology Roundtable, is its first attempt to invite the many provosts and professors in its membership to grapple with how technology can be used to improve teaching and learning on their individual campuses.

"This is not a radical, novel idea," said Steven W. Gilbert, the association's director of technology projects. "A lot of campuses have a technology group, and they'll have a committee of their faculty senate, too. They may each be doing useful things, but they typically don't talk to each other. That's just so inefficient that opportunities get lost."

Mr. Gilbert encouraged those creating roundtables to include the chief academic officer, faculty members who use technology and those who don't, and representatives of the computer center, library, bookstore, and the offices of faculty development, student affairs, and facilities management.

Representatives of the American Federation of Teachers and the National Education Association said union representatives should also be included. The greater use of technology would lead to discussions of collective-bargaining issues, such as faculty workloads and the ownership of intellectual property, they said.

Roundtable members here heard speakers bemoan the low-tech nature of instruction in most college classrooms. They pointed to the research done by Kenneth C. Green, of the University of Southern California, who has found that 16 per cent of classes use computer laboratories and 8 per cent use electronic mail.

"In this field of dreams, even if you build it they won't necessarily come," said Jane Marcus, an information-technology administrator at Stanford University.

E-MAIL FOR ALL

Mr. Gilbert urged roundtable members to consider adopting a variety of strategies for getting more faculty members to improve their teaching by using technology. A simple effort designed to reach a lot of people would be to provide electronic-mail access to all professors and students, so that they might continue class discussions on line. A more intensive undertaking might involve providing grants to faculty members to help them identify or create software that would be incorporated in their courses.

Colleges represented here were at different points in establishing technology roundtables. John Rueter, a biology professor at Portland State University, said his institution was still planning its group and was considering how it would fit in with an existing advisory panel on technology.

Stephen A. Roderick, dean of the education school at Fort Lewis College, said his institution already had a technology committee with a broad-based membership. The meeting here, he said, offered a valuable opportunity to compare notes with other institutions. "The sharing of ideas and of similar problems, frustrations, and good solutions is what I see as the helpful thing."

WORKSHOP IN JULY

The higher-education association plans to bring roundtable participants together again in July for a workshop in Arizona.

A World-Wide Web page for the roundtable project has been developed. Internet users who have Netscape, Mosaic, or another Web program can connect to http://www.ido.gmu.edu/aahe/Welcome.html. ■

who are familiar with the studio courses strongly endorse them.

"In the new mode, no one goes through the motions—not the faculty, not the students," says Gary Judd, dean of the faculty. "They take on very different roles."

Joseph G. Ecker, a professor of mathematics who has taught studio calculus, says: "In the studio setting, there's so much more going on in their heads. Instead of four hours of listening and watching, there's four hours of thinking and doing."

Mr. Roberge, an associate professor of physics, says he appreciates knowing what students are and aren't learning before the first examination, in the fourth week of the semester. "Every day you do something that forces the students to use the concepts you're trying to get across. Having that day-by-day feedback makes a tremendous difference."

GETTING STUDENTS INVOLVED

Alan Cutler, a professor of chemistry, is teaching introductory chemistry to a class of about 50 students while other faculty members

"I think the studio approach is going to transform all of those courses that everybody suffered through."

work on integrating laboratory assignments into the class. Computerized lab assignments should be available in the fall, enabling students to attend five hours of studio classes rather than four hours of lectures and three hours of laboratory, as they do now. Rensselaer plans to have the entire introductory class—720 strong—in studio settings when new computer rooms are completed in 1996.

"Writing the world's best set of notes on a blackboard is not an education," says Mr. Cutler, who is developing the studio class with Tom Apple, an associate professor of chemistry. "The trick is to get the students involved."

Mr. Ecker, the mathematics professor, acknowledges that not every professor will be as pleased with the studio format as those who have been involved thus far. Helping students work through problems on their computers requires more patience and interpersonal skills than does lecturing from the front of the room, he says.

"I can think of faculty across the campus who are very formal," he says. "They've been Herr Professor/Dr./Sir for too long. They may not function very well in a studio setting."

Others, such as Mr. Roberge, note that the constant pressure on faculty members to produce research could discourage some from investing time in revamping courses. "I was afraid this was going to turn into a huge time sink," he admits.

His experience, though, has left him with no regrets. "I'm thoroughly convinced this is the way to go." ■

TECHNOLOGY UPDATE

- **CD-ROM provides access to hard-to-find Buddhist texts**
- **Course on hazardous wastes includes a 'virtual laboratory'**
- **Researchers use new techniques to help dyslexic children**

A worldwide group of researchers is making some of the least accessible religious writings available to more people electronically.

The group has turned to the CD-ROM to provide access to Buddhist texts that have been difficult to find because of their size and the diversity of styles and languages in which they were written.

Lewis R. Lancaster, a professor of East Asian languages at the University of California at Berkeley, heads a team, called the Electronic Buddhist Text Initiative, that has managed to place all 52,000 pages of the Siam edition of the Pali canon on a single CD-ROM. Developed in cooperation with the Mahidol University in Bangkok, the disc is being distributed by the American Academy of Religion Scholars Press, where Mr. Lancaster is editor of the electronic-publication program.

Putting the texts on a CD-ROM lets scholars do research that would otherwise be impossible. "We didn't have sufficient indexes and concordances for a 52,000-page work," Mr. Lancaster says. The digitized version lets scholars look for key words. "A long search now takes about two minutes."

The CD-ROM also makes the texts themselves easier for individual researchers to obtain. The 115-volume printed set is sold for about $12,000, while the disc is less than $300.

For more information, contact Mr. Lancaster, Department of East Asian Languages, University of California, Berkeley, Cal. 94720; (510) 642-3547; BUDDHIST@GARNET.BERKELEY.EDU.

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People who work in laboratories at Stanford University are being trained to deal with hazardous waste by taking a course on a computer that creates a "virtual laboratory."

The computer's task is to walk the user through all the steps needed to handle every kind of hazardous material.

A beginning lab worker is given six months to complete the course, which is available on any computer attached to the campus network.

Craig Barney, manager of chemical-waste programs in Stanford's Environmental Health and Safety Department, says the program was developed largely to meet the needs of people who work in the labs. "We needed flexibility to allow researchers to learn these skills at a time convenient for themselves," says Mr. Barney. "Some of these guys work in the middle of the night."

Mr. Barney says the interactivity of the program makes it a much more effective teaching tool than traditional courses. "They are actually in the virtual laboratory doing these things, and the computer is guiding them through the correct procedures. That's much better than just sitting down listening to someone talking to you and taking notes."

For more information, contact Mr. Barney, Stanford University, Environmental Health and Safety, Ehs-Oak Road, Stanford, Cal. 94305-8007; (415) 725-7529; CRAIG.BARNEY@FORSYTHE.STANFORD.EDU.

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Researchers at the University of Colorado at Boulder have developed new ways of using computers to help children with dyslexia.

Teachers have been using computers for years to help children with dyslexia learn how to read, but a substantial portion of dyslexics have not responded well to such programs.

For the last eight years, a group led by Richard K. Olson, a professor of psychology, has been using computers equipped with synthetic speech to help dyslexic children. A child reading on a computer can click on a word and listen to the computer pronounce it as many times as needed. "We found some kids benefited a lot from that kind of help, but others needed more," says Mr. Olson, who is also associate director of the university's Center for the Study of Learning Disabilities.

The new project is aimed at dyslexics who suffer from poor phoneme awareness. Dyslexia is not a matter of simply transposing letters, as many think. It can be best thought of as a language problem that makes it difficult for people to associate sounds with printed words, particularly the sounds, known as phonemes, that are within syllables.

The new program relies on a set of computer games and on associated exercises handled with an instructor in a small group. After getting a better grasp of phonemes, the children read on the computer. "This gives them the basic skills to learn," says Mr. Olson.

Mr. Olson says computers are important for this kind of work. "When you have a limited amount of teaching resources, computers provide teaching efficiencies and individualized help," he says.

For more information, contact Mr. Olson, Department of Psychology, Campus Box 345, University of Colorado, Boulder, Colo. 80309; (303) 492-8865; ROLSON@CLIPR.COLORADO.EDU.

—DAVID L. WILSON