House panel that oversees medical research funding and a strong advocate for the National Institutes of Health, received a 38% rating in the survey.

The timing of the survey's release—6 weeks before the congressional and presidential elections—is what bothers David Goldston, legislative director for Representative Sherry Boehlert (R–NY). Boehlert, who scored 60% on the scorecard, is a longtime House Science Committee member who is widely seen as a supporter of science. While Goldston agrees that the science community needs to expand its grass-roots activities, he argues that a survey is not the right way to go about it. "This is like firing a salvo. It's a way to start an argument, not a discussion," he says. "Ratings are done to defeat people—to say, 'Let's get rid of these guys.'" Releasing such a survey without taking that into consideration, he adds, is "woefully and dangerously naïve."

Apple says that the survey was released as soon as he could analyze the voting records of the 104th Congress, which has wrapped up debate on most science issues, and that the pending election was immaterial. But he adds that "we did not expect what we saw." Given the forceful response so far from those inside the Beltway, he also may not have expected the furor that those results have created.

–Andrew Lawler

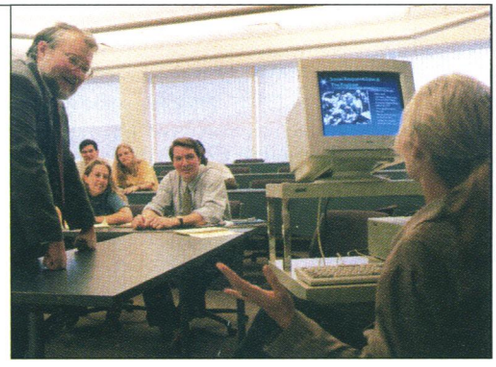
UNDERGRADUATE EDUCATION

In Boston, a Revolutionary Experience

BOSTON—The National Science Foundation (NSF) has been trying to jump-start a revolution in science education, urging science faculty to pay more attention to teaching the vast majority of students who won't go on to become scientists themselves (*Science*, 19 April, p. 345). One institution that has taken NSF's admonishments—and its financial support—to heart is Northeastern University, which is about to implement sweeping curriculum reforms intended to integrate science with other disciplines. Northeastern's new program, called Academic Common Experience, or ACE, is an attempt to force students' major departments to provide a well-rounded education, a goal that will lead to less course specialization and more interdepartmental connections.

Launched just this autumn, ACE is still embryonic, and some worry that the university won't provide faculty members with the extra time and money they will need to implement it. But educators around the country give it high marks, and other universities are already looking to Northeastern's experiment as a possible model for their own curriculum overhauls. "Higher learning shouldn't be a collection of disjoint boxes," says mathematician Melvin George, interim president of the University of Missouri and chair of an NSF advisory panel that produced a report this spring urging such reforms. "Our education system has to help students make the connections" among disciplines, says George, adding that he is "very much in favor" of Northeastern's approach.

Northeastern is well known for its cooperative education programs, in which students alternate courses with paid professional work. But university officials admit that in the past, the school's seven specialized undergraduate colleges—which range from nursing to liberal arts and have no common curriculum—haven't fostered interdisciplinary connections. Students major in one field and must choose a mere handful of classes out of hundreds that can fulfill "general education" requirements. As at most schools, science and engineering courses cover only content, leaving communication skills, critical thinking, and the social context of science to other departments, says Gerard Voland, a professor of industrial engineering. The result: science graduates unable to communicate clearly and liberal arts graduates without a basic understanding of the sciences. That is just the situation NSF lamented in its report.



GRAHAM RAMSAY/NORTHEASTERN UNIV.

ACE in the whole. Northeastern engineer Gerard Voland leads discussions of ethics and history.

But under the new plan, which will be phased in over 6 years, topics Northeastern students once encountered only as part of their "general education" courses will be revisited and reinforced in their major courses. Music and dance courses, for example, will include units on the physics of sound, motion, and light, while political science courses will include Internet-based tasks to enhance students' "information literacy." Northeastern's science, math, and engineering departments are implementing their portions of ACE with the help of a $200,000 grant awarded this summer as part of a new NSF program on institution-wide science education reform.

ACE arose when the school tried to define a core liberal-arts curriculum. Its first attempt collapsed amid faculty disagreement, but in 1992, an informal group of faculty members and administrators revived the issue by focusing not on existing courses but on the broader question of what students need to know. The result, 3 years later, was faculty, administration, and even student consensus on a list of goals for undergraduate education, including not just course content but thinking and communication skills, technological literacy, and historical and aesthetic perspectives.

ACE puts chief responsibility for reaching these goals on the major departments, requiring each to assess its curriculum for weaknesses, choose an initial goal, and devise a way to assess success. The geology department, for example, knew from discussions with employers that its graduates had weak writing skills, so its first task under ACE will be to integrate more technical writing into its courses.

To achieve ACE goals, faculty members are beginning to collaborate across department boundaries to develop interdisciplinary teaching "modules." Physicists, for example, are working with health sciences faculty members to develop a sequence of biomedical physics courses. And Voland helped design assignments in fall-quarter freshman English and calculus courses to help prepare students for a spring-quarter engineering course, in which they will design and present solutions to real-world problems such as unexploded land mines and tropospheric ozone pollution.

All this adds to teaching workloads and course-development budgets, and some Northeastern faculty members fear that "the university wants to take credit for these initiatives, but when it comes to funding them, they aren't willing to do it [fully]," in the words of one science professor who asked not to be named. But students seem to like the idea. "With ACE, the student is at the center of learning, instead of the material," says Herby Duverné, the Northeastern student government's vice president for academic affairs.

Officials at other schools say they are keeping an eye on the changes at Northeastern and elsewhere as they develop their own reforms. "Our old gen-ed systems were not about learning; they were about administrative ease," says Ralph Mullin, a professor of management at Central Missouri State University, where similar reforms are under way. "Passing courses and getting a sheepskin shouldn't be the goal of an undergraduate education."

–Wade Roush