How Will the New Engineering Education Criteria Affect Physics?

Two years ago, when the influential Accreditation Board for Engineering and Technology unveiled its new set of criteria for engineering education, it wasn't exactly front-page news. But in the physics community, word soon began to spread: ABET was no longer explicitly requiring engineering students to take a year of calculus-based physics. Physicists prone to worry even speculated that engineering departments might drop, or at least substantially reduce, the physics component of their curriculum.

Such "service" courses for nonmajors are, of course, the bread and butter of many physics departments. Each year in the US, about 95 000 engineering majors enroll in introductory physics, and many of them, especially those in physics-intensive disciplines like electrical and mechanical engineering, go on to take several more physics courses. Without those students, a lot of departments would have trouble justifying their existence, especially in light of recent drops in physics degree production at all levels.

So what do the new criteria mean for physics departments? First, a little background. ABET, based in Baltimore, Maryland, is the sole agency responsible for evaluating and accrediting engineering degree-granting programs in the US. Although accreditation is voluntary, most state licensing boards require engineers to graduate from an ABET-approved program, and over 95% of US engineering programs do carry the board's seal of approval. ABET therefore wields considerable authority in setting the engineering education agenda.

Physics departments may soon have to rethink the "service" courses they teach to engineering majors.

ABET began accrediting schools in 1936, and over the next six decades, the criteria it used to make its evaluations expanded in both degree and specificity, explains Dan Hodge, the agency's accreditation director, "until finally we recognized that the criteria were tending to stifle innovation." And so, "starting with a clean sheet of paper," Hodge says, ABET rewrote its criteria. Under the new system,"programs first need to define objectives and then establish processes to measure how effective they are in reaching those objectives." Schools are then evaluated by teams of outside reviewers, who visit a campus, talk with students and faculty, look at course syllabi and textbooks and check out laboratory facilities and equipment.

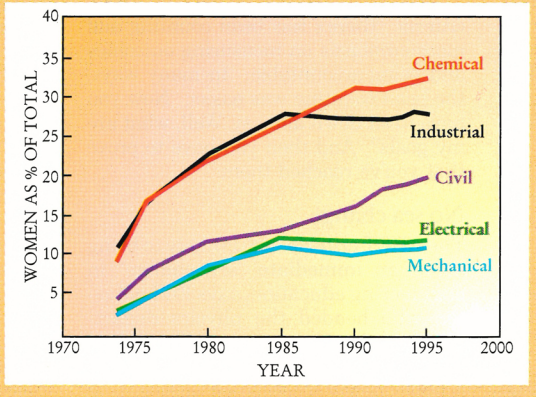
This academic year marks the first in which schools are being reviewed under the new criteria, known as EC2000 (and listed on the ABET Web site at http://www.abet.org). Through the year 2000, schools have the option of being evaluated under the old system. After that, however, any school seeking ABET accreditation will need to conform to the new criteria. (Departments are typically evaluated every six years, so an institution could postpone adopting the new criteria until 2006.)

Proficiency in physics

So is it true that the new criteria no longer require engineering students to take physics? Yes and no. Like the old criteria, the new system still requires engineering majors to take "one

Physics Anxiety in Engineering

Why do so few women major in electrical engineering? Or mechanical engineering? Or nuclear engineering? When it comes to representation of women, it turns out these fields do about as poorly as physics, awarding between 12% and 16% of their undergraduate degrees to women. Conversely, the representation of women in industrial, environmental and chemical engineering is nearly three times as great. (The graph at right, from the Engineering Workforce Commission, shows the distribution by field of US engineering degrees awarded to women from 1974 to 1995.)



A quick comparison of the course requirements in various engineering fields reveals another interesting difference: The higher the physics content, the lower the proportion of women. Could it be that—gulp—physics is responsible for the underrepresentation of women in these fields?

That's what the staff at Cornell University's Women's Programs in Engineering suspected. With support from the Alfred P. Sloan Foundation, they conducted a survey of 500 women engineering majors at eight universities, to find out why they had chosen their particular fields. What they found was that many of the women who had chosen chemical, environmental or industrial engineering did so because of "negative experiences in physics" at either the high school or college level. Those in physics-based engineering majors, by comparison, were twice as likely to report having had positive experiences in physics.

Survey author Julie Anne Schuck believes that physicists don't intend to turn away women students. "Most physicists I've interacted with really want their students to learn," she says. "But they may be constrained by class size or other administrative problems." To help overcome students' physics anxiety, the Cornell office published a pair of booklets, one for instructors and the other for students. Not surprisingly, many of the booklets' suggestions—such as using cooperative learning and hands-on activities—echo those made in earlier reports on improving the classroom climate for physics majors.

Highlights of the survey report, as well as the instructor's and student's guides, can be downloaded from Cornell's Physics Anxiety Web site, at http://www.engr.cornell.edu/ss/womens_pgms/phys_anx. html.

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