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ENGINEERING GRADUATES IN 2004 BETTER PREPARED THAN GRADUATES OF A DECADE EARLIER

University Park, Pa. – Students who earned undergraduate engineering degrees in 2004 are better prepared to enter their profession than were similar students who finished their degrees in 1994, according to a study recently completed by the Penn State Center for the Study of Higher Education (CSHE).

The 3½-year study of the impact of new accreditation standards in engineering was commissioned by ABET, Inc. and presented October 27 at its annual meeting in San Diego. ABET is a federation of 30 professional and technical societies and the accrediting body for college and university programs in applied science, computing, engineering, and technology.

“In all nine engineering knowledge and skill areas emphasized by the new standards, the 2004 graduates in the aggregate have significantly, and often substantially, higher skill levels than did their counterparts from a decade earlier,” according to Dr. Lisa R. Lattuca, study director and assistant professor and research associate in the Center. The skills examined include basic math and science, design and problem solving, experimental skills, engineering science applications, technical and interpersonal communications, as well as working in teams and life-long learning. The 2004 graduates also have greater knowledge of societal and global issues, as well as ethics and professional standards.

The CSHE study draws on information from 5,500 graduates of the Class of 1994 and 4,300 Class of 2004 graduates at 40 institutions nationally. The study also includes information from 1,300 faculty members, 150 program chairs, 40 engineering deans, and 1,622 employers. Study participants in over 200 programs include seven engineering fields: aerospace, chemical, civil, computer, electrical, industrial, and mechanical engineering.

The Penn State report details a number of changes that have occurred between 1994 and 2004 in program curricula, as well as in engineering faculty members' teaching practices and perspectives on undergraduate education. Program heads report greater curricular emphasis since 1994 on students' communications skills and ability to work in groups, as well as on the application of modern engineering tools.

Faculty members report increases over the past decade in the emphasis they give in their courses to engineering design, modern engineering tools, and to teamwork, and 2004 graduates confirm these changes. Compared to their 1994 counterparts, the 2004 graduates report more exposure to active and collaborative teaching practices, more feedback from instructors, and more interactions with faculty members both inside and outside of class. Faculty members also report an increase over the past 10 years in the recognition accorded to teaching in the promotion and tenure process.

Patrick T. Terenzini, distinguished professor of higher education at Penn State and co-principal investigator on the project, said "All of the changes we observed can be statistically linked in a temporal sequence from ABET's introduction of its new outcomes-based accreditation criteria, to changes in what and how programs and faculty educate their students, to the kinds of experiences engineering students have, and finally to what students report they are, in fact, learning. All these changes and increased learning outcomes are consistent with what one would expect if EC2000 was having an impact." Terenzini noted that the 2004 graduates also score higher than the 1994 graduates in foundational math and science, a finding that appears to be especially good news for America's colleges of engineering.

"Some faculty members," Lattuca noted, "had feared that the curricular and instructional changes needed to meet the accreditation guidelines might come at the expense of instructors' attention to and student performance in basic science and math skills. The evidence indicates that has not happened."

Dr. J. Fredericks Volkwein, professor of higher education at Penn State and another co-principal investigator, noted that industry representatives report seeing somewhat less change in the preparation levels of graduates than is suggested by program chairs, faculty members, and the two classes of graduates themselves. Nonetheless, in assessing the skills of recent graduates, 92 percent of the employers report that the recent graduates they hired are "adequately prepared" or "well-prepared" in their use of math, science, and technical skills. Also, more than three out of four employers judge their new hires as well-qualified to apply problem-solving skills, communicate effectively, work in teams, and engage in life-long learning.

Fewer employers (52 percent) consider recent graduates to be adequately or well prepared in their ability to understand important contextual considerations and constraints on engineering. Employers are mixed in their assessments of whether recent graduates are better prepared than graduates a decade ago. In describing these results, Volkwein said, "The areas of greatest improvement are in teamwork and communication skills and ability to learn, grow and adapt—areas of high importance to employers. Moreover, larger employers recruiting nationally are reporting more positive change than those at smaller companies recruiting locally."

Beginning in the mid-1990s, ABET introduced *Engineering Change 2000*, a document that specified 11 engineering skills and learning outcomes for graduates that are now used in program reaccreditation reviews. “ABET has been requiring programs to engage in serious assessment and continuous quality improvement for reaccreditation,” said George D. Peterson, ABET’s executive director. “We thought it was time that ABET ‘walked the walk’ itself and examined the effects of EC2000 on the preparation of engineers.”

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