Some subjects are better taught in industry

Universities are not as well suited to teaching many topics, including software engineering, computer-aided design/ manufacture, and integrated circuit manufacture, as are large, technically proficient companies. During the last five years, major universities have begun tentative efforts in these subjects, but companies such as IBM, Texas Instruments, General Electric, and AT&T have had extensive in-house training programs in these areas for many years. Perhaps the universities would do well to leave such efforts to the large companies.

In the training policies of some companies, the undergraduate university background of new bachelors-level computer engineering employees is completely ignored. Twenty months ago I went on a tour of a major company's educational institute for new employees. They gave each the same three-month, eight-hours-per-day course, a course which assumed no background at all in computer science or electrical engineering. Students with bachelor's degrees in either of those subjects were treated as if they had no advantage over someone with no prior courses.

Universities face a formidable assortment of disadvantages in teaching these subjects that technically proficient industry does not. Almost no university can afford to maintain the equipment necessary to construct large-scale integrated circuits. Even the consortium of California schools teaching LSI design depend on a private company to manufacture student-designed prototype circuits and return them after several weeks or months. As another example, consider the difficulty schools have in developing large-scale software systems with which to teach software engineering. The schools attempt to simulate an industrial environment, but fail miserably.

Faculty members try to keep up-to-date through the literature or summer industrial employment, but in many fields the literature is not detailed enough, and summer is not very long. Professors trying to explain complex industrial processes can rarely draw upon actual experience, and even if a professor comes from industry his experience is outdated in less than five years. Students are often correct in their suspicion that a professor doesn't know what he's talking about.

Industry can immerse a student in a single subject eight hours a day, five days a week, for months if necessary, whereas a university student juggles maybe five courses per quarter or semester. Laboratory courses take less than 10 hours a week of the college student's time, but industry can have him devote 40 hours each and every week to one activity, if that is desirable. McDonnell-Douglas teaches their computer-aided design/ manufacture package in a 30-hour course plus two to three weeks of concentrated practice.

When the term ends, a university course ends. Usually, a vacation of several weeks separates it from the next one. As a result, every professor is aware of the need to review material at the start of each course.

Inconsistent emphasis and presentation from teacher to teacher has a serious negative impact on learning. For example, if one professor wants certain types of comments and stresses their importance while another ignores them, students learn to produce whatever the current professor wants—but they do not learn commenting. Given the choice, they forget comments altogether. A company, on the other hand, can present a single position on an issue through company-wide standards.

At my university, we are beginning to teach computer-aided design to all our engineering students, who, as sophomores, will go through ten hours of online instruction and twenty hours of related lectures. They will not, however, use the acquired skills until they are seniors. Complex skills are quickly forgotten without constant practice; industry can teach skills when they are to be used.

Industry has the incentives of promotions, raises, evaluations, peer pressure, and personal motivation. Universities have the last two, but have only grades to balance against the first three.

Universities should expose students to modern technologies but leave training in the use of these technologies to industry, which should expect to provide months of training to new employees. If these training programs could be provided to faculty perhaps every five years, coordination between universities and industry would be greatly improved to the benefit of both. Universities should teach the concepts which underlie the technologies, the possible consequences of these technologies, and cultural topics—and leave specialized training to the private sector.

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