

FREE RADICALS

Hello again. The last time we talked, I was trying to make the point that the future of successful research universities will belong to those who aggressively partner with businesses, especially start-up businesses, whose commercial interests are aligned with university research expertise. I also addressed the hazards associated with these partnerships, including intellectual property (IP) and conflict of interest (COI) issues.

This time I want to broaden the discussion to include science and engineering (S/E) education in general and how well, statistically speaking, current institutional education is matching the needs of graduates and of the companies that might hire them. To make any generalizations meaningful, I want to confine the discussion to graduates (the "products") majoring in S/E and the high-tech companies (the "customers") who hire them.

Perhaps the first question to ask is, "Is there a problem with S/E education?" If you are an academic from, for example, MIT, Stanford, or a major public institution with an historically strong S/E program, your answer is likely to be, "We are doing just fine, thank you. All of our graduates are getting top jobs at prominent high tech companies. So, there is no problem." My response to this is that even if the metric looks good on how well the alumni are doing, this does not necessarily mean that those alumni received a first rate or relevant S/E education. It could mean that they were bright students who decided to study for a S/E degree at a prestigious university and were quick studies when the company trained them for a specific job. Okay, I don't want my readers to get defensive until the end of this article. So, let's just say, even though universities may have a strong S/E education program, it could always be improved. But how?

By learning what high tech companies really want and need, now and in the future, and then revising relevant S/E courses and labs, and revamping S/E research infrastructure to make them coherent. Specifically, this means revamping and/or updating the

appropriate research infrastructure on campus in the S/E programs so that it will become an appealing facility to those companies whose advanced technology plans have a strong overlap with the research infrastructure and expertise. This infrastructure does



Revamping Education

Revamping Science and Engineering Education to Meet the Needs of Graduates and High-Tech Companies

by Jerry Woodall

not have to be of such scope as to offer "one stop shopping" for an industrial partner. If it is, so much the better! However, it must have at least a facility and expertise that is critically important and compelling to the critical technology development path of a potential partner, and compelling to the point of motivating the company to invest research funds into the facility, its professors, and its students.

In order for the infrastructure to serve the needs of the university, the students, and the industrial partners, the facility must be open and used by both students and company employees working side by side. Also, there needs to be a two-way street between company and university facilities. This means that the IP department and COI committees must be aggressively willing to configure collaborative agreements and manage COI issues that will encourage student participation and

meet the proprietary and commercial needs of the companies without compromising the fundamental principles associated with academic excellence.

"Wait a minute," you say. "Are you suggesting that we let companies determine what universities teach?"

What you propose sounds like what trade schools are supposed to do." Yes and no! Yes, in the case of making alumni job-ready in areas of a university's technology strengths. No, because what I propose will affect only a small portion of a university's total curriculum. Because it is at least part of the university's mission to prepare its graduates to be productive members of society, why not prepare the future alumni at all levels, BS through PhD, to be job-ready as they graduate rather than after they graduate? Why make the employer do all the training?

In this regard it is important to note what I do not mean by revamping S/E education. I am not talking about restructuring university policy to be able to get a grant and/or student scholarship from, for example,

IBM to work in a field of potential interest to IBM. I think this type of relationship is already being used extensively by many enlightened companies and university partners, and, therefore, it is mostly adequate for what it does. The only problem with this approach is that, even though it may give IBM a recruiting advantage to hire superior graduates, all they get is a great student who may or may not be expert in the first job assignment. I think everyone concerned would like all future hires to be job-ready upon graduation, assuming, of course, the graduate has met the other degree requirements!

Finally, if done right, this approach to an S/E education is a winner for all the participants. The university's reputation in S/E education will soar (independent of the U.S. News and World Report ranking). The word will get out and the very best students interested in a career associated with S/E education will clamor to be admitted. The successful and wealthy alumni who got their head start from this approach

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will be more inclined to share their deep pockets with the university endowment fund when the development folks call.

With regard to the students, this approach provides a wide range of shared experimental resources not normally available to research students. This will facilitate greater efficiency in gathering more extensive experimental data needed to prepare more complete project reports and theses. This in turn will provide the necessary time for the student to develop a more fundamental understanding and more focused expertise in a chosen field. It also will provide more time for further iterations in theory and design. This will ultimately result in a better and more universal thesis and job marketability. Asserting my thesis, the student who so chooses will be job-ready as they graduate. (If, God forbid, some students are so mentally challenged as to entertain the notion of an academic career, this S/E education experience will help them to be more effective in training the next generation of entrepreneurs.)

As for the industrial partners, this approach will lead to new employees who will hit the ground running. Finally, for a start up company partnership, this approach may be the only way to successfully move from “stealth mode” into a viable and profitable business. For this case, the company hires job-ready graduates as vital employees and the university becomes the virtual research and development arm of the company. But, I already talked about that last time.

Finally, I would be both naïve and remiss if I did not point out that this approach will be not be readily accepted by a large and vocal constituency of universities and faculty. These are the academics who have for many decades developed their research infrastructure to respond to government defined and funded projects and disciplines. Unfortunately, however convenient or accessible this support has been, this type of research training does not usually meet the needs of the ever-growing for-profit business segment of the world economy. But the good news is — I am not advocating that S/E education abandon this approach. I merely suggest that universities expand or modify their S/E programs to give both the faculty and their students a chance to participate in an important alternative educational paradigm.

See you next time. ■