

The Balance Sheet of American Technical Education

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While it is not time for panic yet, the economic state of American technical education needs some careful attention as we move into the next decade. The problems with the economy and the high cost of attending even a public university have simply exacerbated problems that have been just below the surface for several years. What should be the guidelines for structuring technical education over the next years? This becomes a matter of financial evaluation in terms of costs and benefits or what is viewed as value to incoming undergraduate and graduate students, to industry, to government, to universities and, thus, to society at large. The value of a technical education has historically been without question. Those of us in engineering education need to hear what you believe will drive technical education in the future. What follows are some of my thoughts.

To begin with, a few facts may be helpful to frame the issues. Technical education costs more than general studies at every degree level (high school, associates, bachelors, masters and doctoral degrees) due to the requirement of access to technical equipment in support of the classroom. The latest equipment costs more (normalized by cost of living) and changes more rapidly than it did 30-50 years ago.

Funding for universities in general is supported in greater percentage by tuition compared to the past. When I began teaching, the public funding for the university was just short of 50% of the cost of providing for a degree. Today at my university (The University of Cincinnati), the public funding is just short of 20%. Industry support of technical education was more prevalent in terms of unrestricted funds or donations of equipment. While the current funding situation and specific numbers are different at each university, depending on private versus public universities and teaching-focus versus research-focus universities, the significant drop in public and industry funding and other support means that students need to provide the shortfall in terms of tuition.

How do students view the technical education issues? First and foremost is the cost versus benefit. The cost is the out of pocket tuition and expenses that the students (and their parents) must provide in the expectation that they will obtain a significant job (benefit) upon graduation. At my university, we facilitate and require a co-operative job during the technical education, with the idea of providing both experience and financial support (benefits) for the students. Unfortunately, during the last two years, both jobs for graduates and co-operative jobs for students have been much harder to

obtain. International students have always valued the quality of an American technical education, but new universities are being developed in many countries that, together with internet access, may provide a more cost-effective access to a technical education through a combination of on-site and off-site activities. An improving economy will reduce the impact of some of the cost issues, but how many students do we need for the future and in what disciplines? If we are not careful, we will have too many graduates at the wrong degree level or in the wrong disciplines.

How does industry view technical education issues? First and foremost is the cost versus benefit. Industry needs adequately trained technicians, engineers and scientists at all levels to support different activities within their organizations. This includes entry-level and experienced technical positions as well as technical education for the staff already in place. Students and universities need to be aware of those requirements so that planning can be put in place to accomplish this educational mix. Universities need to educate the right number of students, in the right disciplines and at the right degree level in order to support industry needs.

Universities need to provide continuing education opportunities so that technical staff can pursue additional education as needed by job requirements and career advancement. Continuing education opportunities are often a part of the recruitment process. Right now, industry does not participate in any organized way in this education process or the cost of delivering this education. The economic downturn of the last two years has strained this relationship in terms of jobs for new graduates and co-op opportunities.

Is there a way to support technical education directly from industry? Internships or apprenticeships are a form of this sort of direct technical education by industry, another alternative. Historically, industry actively supported universities in terms of research conducted at universities when there was a mutual benefit to both parties. Many times, this support paralleled the internal support within the company research center.

As the economy has become a major issue, support by industry for university research and their own research centers have dwindled, leaving many industries in a poor position for expansion in the future. More recently, industry and universities have done a very poor job of working together due to intellectual property concerns. This has inhibited the free-flowing transfer of ideas and research that took place in the past

between industry and universities. If we are not careful, industry will not have access to the technical support needed to fuel new and continuing growth in the future.

How does government view the technical education issues? First and foremost is the cost versus benefit. The local, state and federal government provides considerable funding in research areas via local agencies as well as the more notable agencies such as the National Science Foundation, the Department of Defense and defense-related agencies and the National Institutes of Health and health-related agencies. Much of this funding has a secondary effect of supporting technical education but the funding is not managed with an end goal of defining the right technical education that needs to be provided at the different degree levels of technical education.

While government has not proven adept at managing the details of education at any level, some identifiable public policy concerning technical education is sorely needed. Within the State of Ohio, public universities are now being reviewed, graduate program by graduate program, on a regular basis to determine impact to the state to justify continuing support from the state. While this is probably a move in the right direction, some sort of over-arching plan and review might be required. What is good for one state or region may not be good for society at large. In the past, a national focus was indirectly accomplished by major science programs like putting a man on the moon or more recently by some of the defense initiatives, but this has not happened on a large scale since the abandoned Superconducting Super Collider project. If we are not careful, we will continue to spend huge amounts of public funds in technical activities without a measurable return to society in terms of technical education.

How do the universities view the technical education issues? First and foremost is the cost versus benefit. Despite prevalent thought, the size of technical education programs are largely based on capacity (number of staff and faculty, equipment, size of labs, etc.) rather than some measured response to national and international need. With established buildings and tenured faculty, universities are unable to respond quickly to required changes in programs or sizes of programs.

Universities increasingly focus on attracting and retaining students to keep subsidies and tuition support at a maximum. Is this an ethical approach when we realize that some disciplines will not support the number of graduates in that technical area? Particularly, at the graduate level, universities need graduate students to both fill classes

and provide the labor for the research contracts that are increasingly the measure of a quality university. When jobs are plentiful, fewer domestic students continue to graduate school, and universities must rely on international students to fill the void. This is not a national/international need issue but simply a financial issue. If we are not careful, we will overproduce the number of graduates at lower degree levels just because of the financial impact on the universities and under-produce the number of degrees at the master's and doctoral levels while

exporting technical expertise to other countries, effectively supporting future technical growth elsewhere.

How do I respond to these technical education issues? Mostly I worry. In the last two years, when new graduates have not found jobs or I hear from graduates from the last 30 years of my teaching career who have been laid off, I wonder whether we are doing enough planning or that our planning has been faulty. I think that these issues are still important when times are better, but I worry more when times are bad. Un-

fortunately, when I talk with colleagues at other universities, I hear much of the same concerns. The technical education system is a complicated system that is impacted by geographic, financial and political issues that are beyond the control of individuals caught in the system.

I hope this gives you something interesting to think about and, as always, I value your comments on my thoughts. If you have comments, please feel free to contact me (randall.allemang@uc.edu). And best wishes for the new decade! 