

## A Liberal Education for the 2000's

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Traditional “liberal education” is somewhat mistrusted among many in the business and technological community. Several reasons may be offered to account for this discomfort. Historically, in the US the British stress on the liberal arts was countered effectively in the nineteenth century, through the conscious public policy (the “Morrill Act”) of creating land-grant, publicly-funded universities with a practical and applied focus in explicit contrast to the established, privately-endowed liberal arts colleges clustered on the eastern seaboard. Today, engineering students, perceiving typically lower burdens and expectations among their friends in the liberal arts, often characterize that path as the “leisure arts.” And in the last decade or so, the political connotations of “liberal” have not helped, in many quarters, to enhance the stature of the liberal arts as a set of disciplines preparing students for responsible lives as professionals and as citizens.

None of these perceptions, of course, reflect on the original meaning of the “liberal arts.” The root of the “liberal” arts comes from the Latin, “liber” or “free.” From the Middle Ages on, the freedom that counted was from servile manual labor, a freedom conferred by study of the seven traditional liberal (or liberating) arts. These seven arts were organized in two sets: the foundations in the “Trivium” of grammar, logic and rhetoric, and advanced study in the “Quadrivium” of arithmetic, geometry, astronomy and music. In modern terms, the former constituted achieving mastery of thought processes and communications, and merited the Bachelor of Arts degree. The Quadrivium was more “content-driven,” covering the basic sciences of the time (with a heavy emphasis on mathematics even in music); acquisition of these sciences conferred the Master of Arts degree.

From the Renaissance well into the nineteenth century, the status of a liberal arts degree grew in importance, as the predominant certification of entry into civic and professional life at the highest levels. Acquiring at least the Bachelor of Arts degree generally signified the competence to move into virtually any learned area, as well as to mark the status of “gentleman” or above. Probably the apogee of societal reverence for liberal arts education occurred in Victorian England, when liberal arts degree holders, well schooled in the Greek and Latin classics at the

traditional British universities, established and managed the largest empire ever seen.

From the very beginning of the liberal arts tradition, technology and engineering were pointedly excluded. The sciences were always included in the liberal arts; “science,” from the Latin verb “to know,” conveyed dependence exclusively on mental labor. “Technology,” tracing its etymology to the Greek word “*techne*,” “art” or “craft,” and even earlier to the Sanskrit for “hand,” connoted manual labor. Thus liberal arts students used their heads; technologists used their hands and were branded as “servile” or “mechanical.” (Recall the clowns in Shakespeare’s *Midsummer Night’s Eve*, who are the local craftsmen—they’re called the “mechanicals.”) Through much of the nineteenth century, in Anglo-Saxon cultures “mechanicals” and “engineers” by definition were not automatically candidates for genteel society, or positions of high political influence.

The “mechanical” versus “liberal” schism was nowhere greater than in Victorian England, where ironically the Industrial Revolution first flourished, nurtured largely by high-achieving men who came from classes well outside the liberal arts establishment. A linguistic fluke sharpened the schism in England, where the etymological root for “ingenieur” was “engine,” conjuring up images of dirty, smoky, oil-covered engines. In the rest of Europe, however, the equivalent “ingenieur” linked etymologically to “ingenuity,” and from the nineteenth century on, possessors of the “Ingenieur” degree on the Continent commonly achieved a very high social and professional status.

While the British prepared their leaders with a classical liberal arts degree, in France from Napoleon on, leaders were nurtured in the great “polytechnique” institutions where mathematics and engineering (not the classics) were the core. (Thus the “polytechnic” in the name of several of our oldest technological universities still meets with significant resistance especially in former British colonies, but is admired in cultures whose educational heritage comes from French or German models.) England eventually paid the price for relegating engineers to the servile orders; while science still flourishes, engineering has fallen well behind world class standards.

While a liberal arts degree certainly remains to this day a strong qualification for a successful public and personal career in the US, it is noteworthy that (according to a recent Chronicle of Higher Education report, 2 September 1996, p. 22) only about 1/3 of undergraduates who received degrees in the most recent year surveyed (1994) were in the liberal arts, broadly defined. Only the most zealous advocates of the traditional liberal arts would dismiss knowledge of the “practical arts” as crucial to any form of meaningful modern education. Institutions as diverse as small Massachusetts colleges (Bradford) and large western universities (Arizona) are combining liberal and engineering programs, even offering the B.A. and B.S. together as a package.

Clearly then, returning to the origins of “liberal” arts, the knowledge needed in the next millennium to achieve the traditional goals of freeing people from servile and uncreative jobs and lives has changed. Few would argue today, as Matthew Arnold did just a little over a century ago in “Science and Literature,” that profound immersion in the language and culture of the Greeks and Roman is the best preparation for life. Technology and science simply cannot be relegated to a secondary role in modern life.

To be “free” in the liberating sense of the “liberal arts” in the third millennium, people will have to acquire a reasonable level of sophistication in ways of thought increasingly characterized by an “engineering” or “technological” education. In recent years, corporations like Boeing, professional societies like ABET, and government agencies like the NRC have all offered lists of attributes which characterize a modern engineering professional. All these assessments of what a technological professional should be able to do draw upon talents and tools developed in both the Trivium and Quadrivium. The skills both of communications and logic as well as of mathematical and scientific modeling are required for modern and future professionals.

My own list of objectives for a contemporary “liberating” education include understanding the following:

- how new knowledge is generated in two or three different modes, of which one should be the “scientific method” based on the analysis of data gathered from experiments consciously chosen to elicit certain results.
- how large masses of data are analyzed, using computer and/or mathematical models to find and assess patterns;
- how open-ended questions are framed and discussed, and how decisions about which approaches are more promising are reached, often

in social contexts involving people from different disciplinary and even ethnic backgrounds;

- how the societal context of professional practice affects one’s life and career, and
- how to discuss effectively all of these consequences of a modern liberal education within a variety of audiences, including with cultures new to the speaker.

Recall that the classical distinction between the Trivium and Quadrivium was that the former (grammar, rhetoric and logic) basically taught the tools for a liberal education, while the latter (geometry, arithmetic, astronomy and music) explored the four pillars of secular intellectual inquiry existing in the Middle Ages. In the traditional liberal arts education, grammar, rhetoric and logic all extended themselves into the related disciplines, respectively, of literature, law and philosophy. These three disciplines of the Trivium may be further mapped and extended for modern purposes as follows:

Grammar as communication skills, equally important in written and oral forms, both in natural and electronics environments. Rhetoric as skills of persuasion, equally important in teamwork and in technical writing. Logic as skills of effective organization, equally important in verbal and mathematical disciplines.

The modern Trivium thus becomes the foundation in verbal and mathematical literacy requisite for liberating students from a life of servility (nowadays read “flipping fastfood hamburgers” rather than tilling fields).

The modern Quadrivium can, with a little liberty, be remodeled into the various professional, scientific and technical disciplines that build upon the foundations in mathematical and verbal literacy and logic. Thus, as many argue today, pitching the first professional degree in engineering at the Master’s level implies that students first acquire the intellectual tools needed for analysis (the list of objectives above in the Trivium, which really boil down to logic and communications). Once they demonstrate this level of competence, they can begin to focus more exclusively on the content area of interest. The fundamentals learned at the Bachelor’s level should become instruments used increasingly skillfully in new and more complex work situations – a true liberating education. The Master’s degree appropriately would mark significant specialization within a disciplinary field, often achieved through internships or correlated industrial experience. Such a distinction should help clarify the relationships between learning the unchanging fundamentals (liberal education) and mastering ever-changing specialized fields (professional education.)

In summary, I believe we can make a credible translation of the traditional liberal arts program, with

its heritage of success and prestige, into precisely the kind of contemporary liberal /liberating education modern technological universities are presently well positioned to provide.