

Are the Liberal Arts Still the Heart of the American Research University?
Some Observations from An Engineering Professor...

James J. Duderstadt

LS&A Symposium on the Liberal Arts
The University of Michigan
May 23, 2013

Let me commend you on your courage for inviting a “gearhead” to comment on the role of the liberal arts in American higher education. It is true I graduated 49 years ago with a B. Eng. as part of the last class of the ancient Sheffield Scientific School before undergraduate engineering was absorbed into Yale College, only to soon lose its accreditation because Yale preferred a more liberal arts based curriculum. Actually, the term “engineering” was already an oxymoron at Yale since we took far more courses in what you would call “the liberal arts and basic sciences” than in engineering.

In fact, the Yale faculty members I recall most vividly were largely from the liberal arts: John Morton Blum (20th Century American Political History), Vincent Scully (Modern Architecture), William Kesson (Child Psychology), and Alan Bromley (Nuclear Physics...well I had to add that one...) Actually, the best liberal arts teacher I had was while I was a graduate student at Caltech. It was Richard Feynman! Although his course was listed as advanced quantum mechanics, in reality it was mostly philosophy...a la Feynman.

Looking back over the past five decades, it is clear that Yale’s philosophy of undergraduate education has shaped my entire career. But rather than quote the definition of a liberal arts education from the Yale handbook, perhaps it is more appropriate to quote a more Michigan-centric vision of our objective for undergraduate education. Since Harold Shapiro is unable to join us this evening, perhaps it is most appropriate to quote his wonderful list of the objectives of a liberal education given in 1988, just as he was preparing to leave Michigan for Princeton:

“The need to better understand ourselves and our times, to discover and understand the great traditions and deeds of those who came before us; the need to free our minds and our hearts from unexamined commitments in order to consider new possibilities that might enhance both our own lives and build our sympathetic understanding of others quite different from us; the need to prepare all thoughtful citizens for an independent and responsible life of choice that appreciates the connectedness of things and peoples.” (Shapiro, 1988)

So, where do the liberal arts fit into the contemporary university? Of course, for the medieval university, they comprised the curriculum for free men (from the Latin *liberalis*) rather than those skills characterizing the servile arts (like masonry and engineering, I suppose). Although, originally identified by the disciplines of the *trivium* (grammar, logic, and rhetoric) and later the *quadrivium* (geometry, arithmetic, astronomy, and music) that comprised the curriculum of the medieval university.

Each age has added further to the liberal arts, e.g., the humanities, the physical and biological sciences, and the social sciences in the 19th and 20th century. Still excluded from the liberal arts are topics that are specific to the professions such as medicine, pedagogy (i.e., education), business, and of course, engineering!

As Shapiro notes, additional objectives have also been added to the concept of a liberal education, such as freeing of the individual from previous ideas, the disinterested search for truth, the pursuit of alternative ideas, the development and integrity of the individual, and the power of reason. Here, it is important to acknowledge that the content of a liberal education for the 21st Century continues to evolve.

Yet, I believe that as difficult as it is to define and as challenging as it is to achieve, perhaps the elusive goal of liberal learning remains the best approach to prepare students for a lifetime of learning and the capacity to both adapt to and occasionally drive change.

Where Do the Liberal Arts and Basic Sciences Fit into the University?

So, let me return to the question before us: What is the place of the liberal arts and basic sciences in the research university, which has much to do with disciplinary organization as philosophical objectives. The usual Copernican view of the solar system of the university would place the liberal arts college and its core academic disciplines as the sun, the four inner planets as the most powerful professional schools—Medicine, Engineering, Law, and Business—and then a series of elliptical orbits for the remaining professional schools, depending upon their quality and priority within a particular institution. (Actually, some universities have evolved almost into a binary star system in which the medical center has assumed a size and financial importance almost comparable to that of the rest of the university. Some of my liberal arts colleagues suggest that a more appropriate astronomical metaphor would be that of the university as a star orbiting about a gigantic black hole created by the gravitational collapse of the University Hospital and the Athletic Department ...)

But I have a somewhat different model: At the center of the university solar system would be the University Library and the Graduate School (posed

strategically on either end of Ingalls Mall running through the core of our Central Campus). This, of course, is the contemporary remnant of the medieval university, the *Universitas Magistrorum et Scholarium*, the union of scholars and masters both mastering and extending knowledge.

Then the nearest four planets, where one at least has a chance of finding life, would be the liberal arts...the humanities, the arts, the natural sciences, and most recently the social sciences. Still farther out are the gas giants, the four large professional schools: medicine, law, engineering, and business.

Finally, there are a range of other planet-like disciplines...some very similar to the liberal arts (e.g., the performing and visual arts), some that behave like comets (e.g., public policy, information sciences), and some that appear to be remnants of ancient university activities (e.g., Kinesiology as the remnant of Physical Education).

I might add that with a very good telescope, one might even see possible signs of life a light year away from the sun, from the so-called Oort Cloud, where has-been presidents are exiled and only visible when they launch an occasional comet to rattle about the inner planets to shake things up a bit.

But What about JOBS!!!

Of course, while universities such as Yale, Virginia, and Michigan are still deeply committed to the importance of the liberal arts and sciences as the core of an undergraduate education, what about the rest of American higher education? To be sure, there is growing pressure to refocus college education more on preparing students for the job market (although most of us always used to warn freshman that the purpose of college was not to prepare you for your first job but rather for your last job).

In fact, many who should know better seem to think that universities should focus their programs on meeting contemporary workforce needs. The current governor of Michigan has four degrees from the University of Michigan and made many millions from high tech enterprises, and yet a few weeks back, I argued with him for over an hour about his premise that we should be turning out experts on big-data and analytics, rather than broadly educated citizens capable of adapting to a world of rapid change.

Last month, Terry Sullivan and I participated in a major workshop conducted by the Board on Higher Education and Workforce of the National Academies (I currently chair the policy division of the Academies), that was focused on issues such as the cost, price, and value of a college education, along with “who pays and who benefits” and involved many of the leaders of American higher education policy. The warning from this group is that we simply have to pay attention to concerns of the body politic about the importance of workforce preparation as a key component of undergraduate education.

Yet, here I have several datapoints we might consider:

Datapoint 1: MIT: For a number of years, MIT has been doing careful studies of the experiences of their students following graduation. Despite MIT's reputation as the source of the nation's ultimate gear-heads, they find that their students intentionally pursue a decade or more of career exploration following graduation, intentionally shifting not only jobs but careers...not only from various engineering activities to startups to graduate education to public service (Teach for America, Peace Corps) to international experiences to find out what they really like to do. Only when they begin to acquire the responsibilities of a family do they narrow down on a career. In reality, the MIT faculty members are beginning to realize that at least for their students, the undergraduate experience lasts well over a decade beyond the campus curriculum.

Datapoint 2: Lifelong learning: Remember that during the 20th century, human life-expectancy essentially doubled! While biologists suggest that there may be fundamental limits on human life, it is certainly the case that today's graduates are likely to have much longer careers than we have had, in an environment of rapid change that is likely to require continuous learning and upgrading of skills as they shift careers many times.

Datapoint 3: Most of you are aware of the major study that Congress asked the National Academies to perform concerning the future of the American research university. Both Terry Sullivan and I served on this study, released last year, that has launched an unusually broad agenda that will keep us busy for the next decade, with recommendations such as fully funding the American COMPETES Act (now in the President's budget recommendation), reforming immigration policy to allow international students with advanced degrees to remain in this country (now part of the proposals in Congress), challenging the states to restore their support to public research universities, addressing those factors such as excessive time-to-degree and unacceptable attrition rates characterizing doctoral education, ramping up investments in both campus research infrastructure and the creation of endowed chairs for junior faculty.

Although the National Academies consists of the disciplines of science, engineering, and medicine, our report stated in strong terms the importance of including the liberal arts in this agenda, and here I quote:

We must recognize the importance of supporting the comprehensive and interdependent nature of research universities, spanning the full spectrum of academic and professional disciplines including the arts and humanities. Research universities and federal agencies should ensure that

they improve education across the full spectrum of research university graduate programs, because of the increasing breadth of academic and professional disciplines necessary to address the challenges facing our changing world, including the social and behavioral sciences, the humanities, and the arts.

(Here I should note the fingerprints of Hunter Rawlings, who was a member of our National Academies committee during its early stages before he was snagged to become president of AAU. His background as a philosopher was quite influential on the study.)

But what about other university programs, particularly in the professional disciplines?

From a Broader Perspective

Despite the central role of the liberal arts, both undergraduate education and graduate education in the academic disciplines have strong professional characteristics in the modern university. In this sense, the contemporary university is strongly engaged in professional education and training. In reality, this is nothing new, since even the medieval university was based on the learned professions of theology, law, and medicine.

The rapid growth of knowledge required for professional practice has overloaded the curricula of many professional schools. This has been particularly serious in undergraduate professional degree programs such as engineering and nursing, since the tendency is to include more and more specialized material at the expense of the liberal arts component of an undergraduate education.

Let me give you an example from my own discipline that might serve as yet another datapoint. Several years ago, the NSF asked me to draft a "Flexner Report" for engineering education. The concerns stated in our report were the following:

1. To compete with talented engineers in other nations with far greater numbers and with far lower wage structures, American engineers must be able to add significantly more value than their counterparts abroad through their greater intellectual span, their capacity to innovate, their entrepreneurial zeal, and their ability to address the grand challenges facing our world.
2. It is similarly essential to elevate the status of the engineering profession, providing it with the prestige and influence to play the role it must in an increasingly technology-driven world while creating sufficiently flexible and satisfying career paths to attract outstanding

students. Of particular importance is greatly enhancing the role of engineers both in influencing policy and popular perceptions and as participants in leadership roles in government and business.

3. From this perspective, the key to producing such world-class engineers is to take advantage of the fact that the comprehensive nature of American universities provide the opportunity for significantly broadening the educational experience of engineering students, provided that engineering schools, accreditation agencies such as ABET, the profession, and the marketplace are willing to embrace such an objective. Essentially all other learned professions have long ago moved in this direction (law, medicine, business, architecture), requiring a broad liberal arts baccalaureate education as a prerequisite for professional education at the graduate level.

Note how appropriate the concept of a liberal education seems today as preparation for the profession of engineering.

Our primary recommendations were:

1. Working closely with industry and professional societies, higher education should establish *graduate professional schools of engineering* that would offer practice-based degrees at the post-baccalaureate level as the entry degree into the engineering profession. (Of course, this is the way it works in the rest of the world, e.g., engineering is a 2nd cycle program in the Bologna protocol.)
2. *Undergraduate engineering* should be reconfigured as an *academic discipline, similar to other liberal arts disciplines* in the sciences, arts, and humanities, thereby providing students with more flexibility to benefit from the broader educational opportunities offered by the comprehensive American university with the goal of preparing them for a lifetime of further learning rather than professional practice.
3. The academic discipline of engineering (or, perhaps more broadly, technology) should be *included in the liberal arts canon* undergirding a 21st-century undergraduate education for all students. After all, in a world in which technology increasingly shapes our lives, a truly liberal education, that is, an education for “free men and women”, should certainly include some preparation for understanding and controlling forces that will shape their lives!!!

(Like most of my studies, this particular windmill continues to resist my tilting!!!)

One More Windmill to Tilt At...

Finally, let me make one other observation that has to do with the impact of technology on universities (the subject of a workshop we hosted at UM last October sponsored by the NSF). Many of my colleagues suggest that today higher education is on the precipice of an era of extraordinary change as disruptive technologies challenge the traditional paradigms of learning and discovery.

What are the opportunities presented by evolving technologies—MOOCs, for example, that threaten to swamp the university with a tsunami (at least according to John Hennessy), or adaptive learning using massive data gathered from thousands of students and subjected to sophisticated analytics, or even cognitive tutors that rapidly customize the learning environment for each student so they learn most deeply and efficiently.

Is this really something new? Or is it just old wine in new bottles? After all, millions of students have been using online learning for decades, most of it at very low cost and some of it even free. There are lots of models: the UK Open University, Sloan Foundation's Asynchronous Education paradigm, the Western Governor's University, the University of Phoenix, etc. Adaptive learning has been used in CMU's cognitive tutor software for years in secondary schools and more recently in their Open Learning Initiative. In fact, during the 1990s, I helped create a "virtual university" in Michigan...and briefly became a "virtual university president".

Furthermore, today's other buzz-words also have established antecedents:

Experiential learning? Think "laboratories" and "internships" and "practicums". That's also what summer jobs are for!

Flipped classrooms? Think "studios", "seminars" and "workshops" or perhaps even more important, the tutorial pedagogy used in Oxbridge for centuries.

Massive markets of learners? In the 1950s, UMTV was providing credit courses for free to hundreds of thousands of learners through real-time television (think Sunrise Semester).

This discussion reminds me of an old Harry Truman quote from my Missouri roots: "The only thing new in the world is the history you do not know."

Of course, MOOCs do have a couple of new wrinkles. For example, they augment online broadcast of canned lectures and automated grading of

homework with social networks to provide free teaching assistances through message boards and discussion groups. They also open up the possibility of using analytics on the learning data generated by these large populations, as evidence by the strong interest of the for-profit sector such as the Apollo group or the Learnit startup.

More broadly, we should recognize that there are many emerging and rapidly evolving technologies, some of which have considerably more promise than MOOCS:

- E-books, i-books, digital libraries, and intelligent data clouds
(machine learning)
- Online synchronous, asynchronous, and four-quadrant learning
- Use of neuroscience to develop sophisticated cognitive tutors
- Massively multiplayer games...World of Warcraft or MineCraft
- Immersive technologies: Second Life, Enders Game

But what do we know about the effectiveness of these technological paradigms? They are certainly generating lots of hype! But where is the beef? After all, MOOCs are COURSES, not college educations. They are more akin to interactive books!!! (Read Neal Stephenson's *The Diamond Age*.)

Where are the careful measurements of learning? Thus far, they are mostly comparisons of performances on conventional tests. Only Ithaca's gold standard measurements of cognitive tutor learning are characterized by the rigor that must be used to assess learning effectiveness.

What are the advantages of these learning technologies? Cost and efficiency? Access to gigantic markets? Standardization or customization? Capacity to gather data on learning and improve pedagogy?

Perhaps. But over the last several weeks I have been picking up rising concerns about both the motivation and the impact of the MOOC movement (some of it at the National Academy level). It comes in part by the fact that the key drivers of the MOOC movement are the most elite and expensive private universities in America, i.e., Stanford, Harvard, and MIT, who are using not only their wealth but as well as their brand names to launch major efforts such as Udacity, Coursera, and EdX, not only to provide new learning opportunities but also (as admitted by their leadership) to create new revenue streams that will help subsidize the increasingly expensive traditional campus-based education on their own campuses. They have been assisted not only by major investments from venture capitalists, but there is strong activity emerging from for-profit providers and publishers. While the goal of educating the world is commendable, the reality is that lots of folks hope to make lots of money off of the MOOC paradigm!

Hence, the first concern is the potentially exploitive nature of the MOOC

model, using the brand name and wealth of rich institutions to provide cheap education to poor students (both globally and domestically) that will eventually create revenue to support expensive education for rich students on the campuses of our most elite and expensive private universities. There would seem to be serious issues of both social equity and exploitive motivation here.

The second concern is the instability that the over-hyping of the MOOC movement is causing in public higher education, as both state governments and governing boards are grasping at the MOOC straws as a way to reduce still further the tax support of public colleges and universities, with the danger of damaging even further this critical higher education sector.

Perhaps it is time to challenge Stanford, Harvard, and MIT to demonstrate their good faith in this effort by allowing students on their own campuses to utilize MOOC participation for academic credit in their own programs!!!!???

Of course, it eventually comes back to the questions of “What is the most valuable form of learning that occurs in a university...and how does it occur?” Through formal curricula? Through engaging teachers? (You can’t package Feynman...although his lectures were wildly popular, if usually misunderstood.) From learning communities? *Universitas Magistrorum et Scholarium*. (The graduate paradigm involving the interaction of masters and scholars will be very hard to reproduce online...and least in a canned format!!!) Finally, we must remember we are talking about undergraduate education for young people, not continuing education for adults!!!

Let me end with two final cautions about the role of technology in higher education. First, as Bill Bowen suggests, it is time to “Walk, Don’t Run” toward the use of cyberlearning. We need lots of experimentation including rigorous measurement of learning outcomes—consistent with broader objectives such as the goals of a liberal education—before we allow the technology tsunami to sweep over us!

Second, and perhaps in contrast, ...imagine that during the lifetime of today’s students the majority of the world’s population will have connectivity to both people and resources. (Actually, over four billion people already do through mobile phone technologies.) Imagine as well that essentially all of the knowledge from human history will be digitized, with most of it both open and searchable “in the cloud”. Finally, remember that the continued evolution of cyber-based learning will occur on a technology platform that has been evolving at the rate of 100 to 1,000 fold a decade since it first appeared 60 years ago. This will likely lead to new possibilities, such as powerful AI agents to support learning (think about a Siri smarter than you are) and even cognitive implants (think “fiber to the forehead”). How do we prepare our students for this cyber-connected world?

Perhaps only through continuing to stress the objectives of a liberal education based on the liberal arts, appropriately updated to the *trivium* and *quadrivium* of a new age!!!

One More Quote from another Former Michigan Provost:

As Frank Rhodes so eloquently stated it in his closing words of reassurance in the Millennium Declaration adopted by the Glion Colloquium in 1999:

“For a thousand years, the university has benefited our civilization as a learning community where both the young and the experienced could acquire not only knowledge and skills, but the values and discipline of the educated mind. It has defended and propagated our cultural and intellectual heritage, while challenging our norms and beliefs.

It has produced the leaders of our governments, commerce, and professions. It has both created and applied new knowledge to serve our society. And it has done so while preserving those values and principles so essential to academic learning: the freedom of inquiry, an openness to new ideas, a commitment to rigorous study, and a love of learning.

There seems little doubt that these roles will continue to be needed by our civilization. There is little doubt as well that the university, in some form, will be needed to provide them.

The university of the twenty-first century may be as different from today’s institutions as the research university is from the colonial college. But its form and its continued evolution will be a consequence of transformations necessary to provide its ancient values and contributions to a changing world. “

And in doing so, it will once again confirm the importance of building its learning and discovery activities upon the firm foundation of the liberal arts as they continue to evolve to serve the needs of a new age!