

What Is Happening In Liberal Education?
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I have been amused by the title that I was given for my talk—what is happening in liberal education. Its very formulation has a contemporaneity—something is happening—now—that represents, for better or worse, a departure from the past. We might lament this departure—**what** is happening in liberal education—or we might welcome it—what is **happening** in liberal education--, but the question itself suggests a stable concept—liberal education—that is undergoing change.

Because I am a professor of English, I will talk a little bit about the root meaning of the word liberal in the phrases liberal arts and a liberal education. The root of the word is the Latin, *liberalis*, pertaining to a free man, as opposed to a slave. Hence liberal education was seen as education appropriate for a freeman, or a gentleman, as opposed to someone in a servile or menial class of society. It has come to mean, of course, study for the sake of general intellectual culture as opposed to education for a professional, vocational, or technical purpose. This dichotomy, between liberal and professional education, took on increasing prominence in the nineteenth century, especially in Victorian England, where there was at once a substantial expansion of scientific and technical education and an increase in the number of degree granting universities, ending the monopoly of Oxford and Cambridge. The debate, about the content and value of a liberal education, needs to be understood in this context, in which class, access, and the privileges of a gentleman are very much part of the subtext. John Henry Newman's classic work, The Idea of a University, which remains today the most comprehensive and influential definition and defense of liberal education, takes shape from this democratic context; Newman wrote the book to define the values and aspirations of the new Catholic college that the Pope had asked him to establish in Dublin. In the Preface he writes, "Robbed, oppressed, and thrust aside, Catholics in these islands have not been in a condition for centuries to attempt the sort of education which is necessary for the man of the world, the statesman, the landholder, or the opulent gentleman." Another Victorian writer, Thomas Henry Huxley has a different perspective. In "A Liberal Education; And Where To Find It," first delivered to the South London Working Man's College in 1868, and in "Science and Culture," delivered at the opening of Josiah Mason's Science College in Birmingham in 1880, he champions a new model of scientific education, in service of a new population, in opposition to the Oxbridge model. Matthew Arnold's essay "Literature and Science," is a direct response to Huxley. It was the lecture that Arnold delivered most frequently on his American tour, in 1883 and 1884; among the schools represented at this symposium, he gave it at Dartmouth, at Princeton, at Swarthmore, and at Smith.

Recalling this historical background is instructive for several reasons. It reminds us that the dichotomy between liberal arts and professional education in which so much of the

discussion of the liberal arts is still cast had a social and historical context. Embedded within it was a debate about class, privilege, and access. In a world today in which almost all students expect to enter the professional workplace, and in which we share a belief in equity of access, I wonder whether we are well served by an opposition between the goals of professional education and the liberal arts that is cast in terms remarkably similar to those of the nineteenth century. I myself believe that it does not, to the detriment of both professions and the liberal arts. I hope that the conversation that we have about engineering over the next two days will help us reframe this debate.

Those of you who have been students of the liberal arts know that the liberal arts curriculum has never been stable. In 1845, when Union College added engineering to its curriculum, I am sure that faculty, students, and alumnae asked, “What is happening in liberal education,” in much the same way that some members of the Smith community asked the question when we launched our engineering program in 1999. The phrase liberal arts suggests to many of us a historical stability, extending back several centuries. Yet any history of the American college curriculum shows that the idea of a stable central core constituting the liberal arts is a myth. In 1754 a prospectus for the new King’s College, later to become Columbia University, announced that the course of study would include surveying, navigation, geography, history, husbandry, commerce, government, meteorology, natural history, and natural philosophy. In this list of subjects, perhaps half would be included among the traditional liberal arts today. When Thomas Jefferson reorganized the curriculum of the College of William and Mary in 1779, he abolished professorships of divinity and oriental languages and added professorships in public administration, modern languages, medical sciences, natural history, natural philosophy, national and international law, and fine arts. These lists are instructive for several reasons. They show that disciplines that we now regard as essential components of a liberal arts education, like the modern languages and the fine arts, entered the curriculum in comparatively recent times as disruptive innovations. They also show that the question in defining a liberal arts curriculum has not been whether to mix the academic, the practical, and the professional, but how to do so.

In the curricular wars of the nineteenth century, much breath was expended and much ink was spilt about the required content of a liberal education, and particularly about the place of Greek and Latin within it. In the final decades of the century, both Ezra Cornell, after whom Cornell University was named, and Charles William Eliot, the legendary President of Harvard, introduced the elective system to their universities in order to defuse these fierce arguments about content. That system, which quickly spread throughout American higher education, introduced greater diversity into the curriculum and allowed students to choose the courses they would take. In a history of the Yale curriculum published in 1901, John C. Schwab described the result: “The history of the Yale curriculum is the story of a medieval workshop, with its limited range of simple tools, all of which the apprentice learned to master, developing into a modern factory, well-equipped with a large stock of tools and machinery, no two of them alike in their construction or use, many of them delicate and complicated, and few of them fully understood or manipulated by all the employees of the shop.” Schwab’s metaphors are particularly resonant for our current symposium, drawn as they are from the practice of engineering. They also provide a lens through which we can reflect on contemporary changes. Schwab’s medieval workshop suggests a simple confidence in a core curriculum that every student learns to master. Very few colleges in the twenty-first century embrace this model of a

universal core, undiluted by elective choice. Schwab's metaphor of the modern university as a factory, in which each worker learns to use his or her set of tools in relative ignorance of those of others, is one that still has resonance today. We live in academic neighborhoods shaped by the assumptions, terms, and tools of our disciplines; travel between them can be arduous. Perhaps we need to imagine the curriculum in the twenty-first century in more electronic terms, as a worldwide web, in which links move us into different disciplines, different cultures, different areas of knowledge, with abruptness and with lightening speed.

So let me turn to my question, what is happening in the liberal arts. In a nod to the seven liberal arts of the ancients, included in the trivium and the quadrivium, I will talk about seven critical developments. The first is a movement away from defining liberal education in terms of subject matter. You are all familiar with such definitions because they constitute the general education requirements at many colleges and universities. To become a liberally educated person, you must take a course in the arts, in literature, in foreign language, in philosophy or ethics, in the social sciences, in mathematics, in the natural sciences. You can substitute your own institution's list of such requirements, which have, as their foundation, a notion of the traditional liberal arts. But increasingly, people in higher education thinking and writing about liberal education have been defining its goals not through coverage of a range of subjects but through what I term capacities. Derek Bok's 2006 book, Our Underachieving Colleges, is both symptomatic of this development and has helped to influence it. The titles of Bok's chapters define what he believes to be the goals of a liberal education: learning to communicate, learning to think, building character, preparation for citizenship, living with diversity, preparing for a global society, acquiring broader interests, and preparing for a career. Notice that Bok expresses these goals through verbs—learning, building, living, preparing. To borrow from Matthew Arnold's definition of culture in Culture and Anarchy, education is not "a having and a resting but a growing and a becoming." At Smith, in the strategic planning process that we have just completed, we have defined the goals of a Smith education through the capacities that we want our students to acquire:

1. Develop the ability to think critically and analytically and to convey knowledge and understanding, which requires

- writing clearly
- speaking articulately
- reading closely
- evaluating and presenting evidence accurately
- knowing and using quantitative skills
- applying scientific reasoning
- engaging with artistic creation and expression
- working both independently and collaboratively

2. Develop a historical and comparative perspective, which requires

- learning foreign languages
- studying the historical development of societies, cultures, and philosophies
- understanding multi- and inter-disciplinary approaches

3. Become an informed global citizen, which requires

- engaging with communities beyond Smith
- learning tolerance and understanding diversity
- applying moral reasoning to ethical problems
- understanding environmental challenges

The emphasis on capacities rather than on areas of knowledge in defining a liberal education reflects consciousness of a world in which new knowledge is increasing exponentially, in which disciplinary boundaries are shifting and dissolving, and in which students can expect to have not just multiple jobs but multiple careers. To return to Schwab's metaphor, students can no longer expect that mastery of a single set of tools will prepare them well for the world that they will enter. Very few will spend their lives at a single station in the world's factory.

Reflecting on the changes in the production of knowledge and the stability of disciplines and careers brings me to the second important development in liberal education I will identify today—the increasing value that we place on interdisciplinarity. It's useful, I think, to take a brief look at the intellectual developments that have motivated this emphasis. Primary has been the reorientation, prominently in the social sciences but to some extent in the humanities, created by area studies. Scholars increasingly came to feel that to understand Latin America, or Africa, or the former Soviet Union, they needed the tools of multiple disciplines—history, political science, economics, sociology. Departments, programs, and research centers were created that focused upon an area of the world rather than a single discipline. Parallel to this development and in some ways similar to its intellectual trajectory has been the emergence of fields of study focusing on populations—women's studies, Afro-American Studies, ethnic studies. The perspectives that this new set of disciplines has brought to the ways in which social position shapes perception and experience has led humanities disciplines to use the tools of social science. Similarly, it has led social sciences to use and interpret texts and artifacts in ways that have been the province of the humanities. Meanwhile, in these same decades, disciplinary boundaries have become increasingly porous in the sciences. Researchers in many fields have come to believe that complex problems require inter-disciplinary and cross-disciplinary analysis, and that we must consequently develop the ability in our students to move across disciplines and bodies of knowledge. This is more than taking a course in music, and a course in English, and a course in economics, and a course in biology. It involves understanding differences in methods of inquiry and argument and asking how the tools and materials of one discipline can illuminate the subjects of another. The problems we face today are complex and far-reaching; their solution requires various modes of inquiry and multiple frames of reference. How can biologists, geologists, and engineers work together to understand watersheds? What can the anthropologist teach us about literary texts and the literary scholar teach the anthropologist? How can the philosopher help us understand the new capabilities we have in genetic engineering?

The distinguished scientist Thomas Cech, who is currently president of the Howard Hughes Medical Institute, calls interdisciplinary fluency “intellectual cross-training.” Using the analogy of athletics, where athletes perform a variety of exercises not directly related to their main sport in order to improve their overall strength and conditioning, Cech recommends intellectual cross training for the scientist, in order to develop the ability to collect and organize facts and opinions, to analyze them and weigh their value, to articulate an argument. Cech is

worth quoting at length for he argues that the humanities are important to the sciences not because they produce more cultured people, but because they produce better scientists. He argues:

“Just as mathematics is considered to be a good exercise for the brain even for those who will never use calculus in the future, so the study of great books, history, languages, music, and many other non-science fields is likely to hone a scientist’s ability to perceive and interpret the natural world. More specifically, in history, literature, and the arts, one is presented with diverse, mutually contradictory ‘data’—different points of view due to incomplete knowledge or the different backgrounds of those doing the viewing. One learns to distill the critical elements from the irrelevant, synthesize seemingly discordant observations, and develop a strong argument. While scientific data are commonly thought to exist on a different plane—absolute, precise, unambiguous, beyond reproach—such is rarely the case. Random error and systematic deviations must be taken into account. Choices of experimental design inevitably affect the results obtained. Interpretations are often heavily influenced by expectations, which in turn are heavily influenced by earlier conclusions, published in the research literature. Scientists need the same skills as humanists to cut through misleading observations and arrive at a defensible interpretation, and intellectual cross-training in the humanities exercises relevant portions of the brain.” One could easily make the same argument as Cech does here so eloquently in reverse, that cross-training in the sciences produces better humanists.

Cech’s concept of intellectual cross training bears an interesting relationship to traditional ideas about the range of disciplines that constitute the university. In The Idea of a University John Henry Newman argues that universities must include what he calls “the whole circle” of studies. For Newman, there is a totality to knowledge, and the aim of education is to teach comparison, discrimination, judgment of relationship. Individual disciplines grow by completing, correcting, and balancing one another. Even though students cannot pursue all the subjects that are open to them, they profit by learning from a faculty who, “zealous for their own sciences, and rivals of each other, are brought, by familiar intercourse and for the sake of intellectual peace, to adjust together the claims and relations of their respective subjects of investigation.” Newman urges intellectual generosity, a live and let live attitude, for he feels the pursuit of knowledge needs “elbow room.” Newman’s concept of the university contains an essential respect for the disciplines, which, like the citizens in a democracy, need to adjust their claims in service of the whole. Cech’s idea, and the modern concept of interdisciplinarity, is somewhat different, for it assumes that you cannot adequately understand complex problems without the knowledge and tools of multiple disciplines. To return to Schwab’s metaphor, he imagines the college or university not as a factory in which we learn to manipulate one set of tools without a great deal of concern about our ignorance of others, but as a worldwide web, in which you continually change your frame of reference. The young men and women entering today’s workforce must be prepared to tackle multifaceted problems that require more than a single discipline for their solution—climate change, energy policy, large scale human migration. They must become skilled at understanding what different frames of intellectual reference, different methodologies, different disciplinary tools have to contribute to the solution of complex problems. Most of the important challenges that we face do not come in neat disciplinary boxes. You need to become adept at stepping out of your particular frame of reference to understand what others might offer. The more intellectual tools you bring to your task, the more likely you are to succeed.

The third development important in liberal education also requires fluency in traveling across boundaries--internationalization. When Eleanor Roosevelt spoke at Smith in 1949, she described the world situation in words that apply today: "How well prepared are we to live in a world that has constantly grown smaller and where we must rub shoulders with people of different cultures, of completely different customs and habits and religions, who live under different legal systems, whose languages are different?" I think we have to answer, almost sixty years later, that we are not as well prepared as we should be to live in this increasingly small and volatile world and that other countries may understand more about us than we do about them. Students need the kind of cultural sensitivity and fluency that enables them to work across different cultures, both within their own countries and around the globe. Most professions and businesses are no longer local, and the young men and women who enter them must understand the different cultures in which they work. There is a growing consensus that we must shape the curriculum in a way that provides students the skills, the knowledge, and the values that enable them to live and work in a global context. This has profound implications for our institutions, for it is a matter not just of language study and course work but of perspective and attitude. When Smith's third president, William Allen Neilson developed Smith's junior year abroad programs in the 1920's and 1930's, he articulated three goals for them: fluency in another language, the capacity to adopt a European perspective, and commitment to international institutions and international understanding. Although we would no longer limit the perspective we would hope our students would acquire to a European one, Neilson's goals seem equally relevant today. Pursuing them may well include faculty development as well as structural change. We need to ask how our policies encourage or discourage study abroad, and how we make study abroad available to students from all financial circumstances and all majors.

The growing sense of the importance of global awareness brings me to the fourth development in liberal education that I would like to describe—training for citizenship. The idea that the goal of a liberal arts education trains good members of society is a classic one. Newman articulated it in The Idea of a University; I am sure that many of our founders claimed it as their purpose in endowing our colleges. Sophia Smith announced as her intention, "to increase women's power for good." I think that we are seeing today a renewed focus on education for citizenship, often realized through centers for community engagement, which bring our students and faculty into neighboring communities in collaborative projects that combine learning and service. New national and international organizations evidence this development. Campus Compact, whose goal is to educate college students to become active citizens, was founded in 1985 with four members; it now has 1100. The Talloires Network an international collective founded at Tufts University in 2005 to promote the civic roles and social responsibilities of higher education now has over fifty members.

The fifth development that I will identify is closely connected to this renewed emphasis on civic education—environmental education. In our growing awareness of the crisis of global warming, many educators are asking what its implications are for our concept of liberal education. David Orr's book, Earth and Mind, is the most comprehensive and passionate argument that we must reshape liberal education to assure a sustainable future. "[T]he worth of education must now be measured against the standards of decency and human survival – the issues now looming so large before us in the twenty-first century. It is not education, but

education of a certain kind, that will save us.” Majors in environmental science and policy began to emerge about thirty years ago; now many institutions find that the study of the environment and the search for sustainable solutions provide a meaningful, unifying context for learning and research. Environmental literacy is increasingly seen as one of the basic literacies that higher education aspires to provide. The commitment to environmental education is necessarily interdisciplinary. The challenges we face won’t be solved through science or economics or politics or engineering alone. Rather, we need to position students for learning at the points where each of these fields intersects – urgently and significantly -- with another.

The final two developments that I will mention in thinking about liberal education both have to do with pedagogy rather than content or capacities. The first is an increased focus on undergraduate research. More schools are engaging students in undergraduate research, not just as the culminating project for those who do senior honors, but for larger numbers of students over the course of four years. We are trying increasingly to engage our students in the process of inquiry and discovery that is the central enterprise of our disciplines. We recognize that such engagement in research is a developmental process, in which students gain the necessary knowledge and tools as they progress through their undergraduate careers. We also recognize that engaging in independent research not only carries intellectual benefits but also develops qualities of character—independence, perseverance, ability to control a large and complex project, decision making.

The final development that I will describe is connected to undergraduate research; it is an increased emphasis on project-based learning. There is an increasing interest, and sense of value, in engaging students in team-based projects with an immediate and practical application. Let me give a few examples, all from Smith: a sociology class studying a current attempt to locate a solid waste disposal site in a poor neighborhood in Holyoke, Massachusetts, including interviewing the principals involved and attending all the public hearings; a museum studies class preparing and mounting an exhibition, complete with catalogue, marketing literature, and educational programs; the development of an online encyclopedia of Smith history from materials in the college archives. Traditional definitions of the liberal arts often claim a dichotomy between general knowledge—knowledge that is appropriately the province of the liberal arts--and knowledge that is professional, technical, or useful, and therefore not the province of the liberal arts. As I said at the beginning of my talk, I think that this dichotomy is a false one. College curricula have frequently included areas of study like architecture or meteorology that we would consider both liberal and professional, and most professional education has its roots in traditional liberal disciplines. There is today a growing sense of the artificiality of the division between professional and liberal arts education, a development reflected in the increasing interest in project-based learning. Such projects enable students to use the knowledge and methods of the liberal arts to address problems of praxis and to use practical problems to test the power and adequacy of our disciplinary paradigms. Furthermore, the development of such pedagogy supports the kind of civic education I described earlier—often bringing knowledge to bear on social problems.

I think you can see from the developments that I’ve briefly described that a lot is happening in liberal education. I would like now to turn to the subject of this symposium, Engineering and Liberal Education, to ask how these developments are connected to engineering

in relationship to the liberal arts. I first want to challenge the very formulation—engineering and the liberal arts, as if they were two distinct areas of knowledge and study. If we are to teach our students to move fluently among the disciplines, we cannot hold to a falsely stable sense of the liberal arts. As I said at the beginning of this talk, the liberal arts curriculum has never been stable. The structure of the disciplines is a historical artifact, and it changes over the course of time. Since I have come to Smith I have been amused by how often I have been asked whether Smith's development of the sciences, embodied in its new engineering program and its plan for a new science center, means that it will abandon the liberal arts. Citizens of eighteenth-century Virginia could have asked Thomas Jefferson the same question when he introduced medical science and natural history into the curriculum. Surely the sciences are among the liberal arts—fields of study that contribute to general intellectual culture. We must make the same claim for engineering. Just as the modern languages and the natural sciences came to be regarded as liberal arts over the course of the nineteenth century, engineering and computer science must become part of a liberal education in the twenty-first. We must determine not only how best to educate engineers in the traditional liberal arts but what role engineering might play in the education of musicians, economists, political scientists, and philosophers. Just as the study of literature and art enriches and deepens the education of scientists and engineers, so the study of science and engineering should enrich and deepen the education of historians and poets.

In his essay, "A Liberal Education; And Where To Find It," Thomas Huxley asks us to imagine a world in which the life and fortune of each one of us depend upon winning or losing a game of chess. He asks, "Don't you think we should all consider it to be a primary duty to learn at least the names and moves of the pieces; to have a notion of a gambit, and a keen eye for all the means of giving and getting out of check? Do you not think we should look with a disapprobation amounting to scorn, upon the father who allowed his son (I would insert the mother who allowed her daughter), the state which allowed its members, to grow up without knowing a pawn from a knight?" Huxley goes on to argue that we are indeed in such a situation, in which the chess board is the world, the pieces are the phenomena of the universe, and the rules of the game are the laws of nature—what he calls later in the essay, "Erdkunde," or knowledge of the earth. I would claim that engineering in the twentieth century is an essential element of the game of chess we need to learn for our survival, a piece of earth knowledge, and that we must think of engineering as a liberal art.

Once we begin thinking of engineering as a liberal art, it follows that not only do we think of engineering education differently; we think of education differently in the classic liberal arts disciplines. When we developed our engineering program at Smith, we were careful to create a structure of requirements for engineering majors that assured substantial course work across the traditional liberal arts disciplines. Students are required to take courses in literature, the arts, historical studies, the social sciences, foreign languages, in addition to the natural sciences and mathematics or analytic philosophy. The program describes its philosophy in the following way: "Engineering is the application of math and science to serve humanity. For graduates to be prepared for practice, post-baccalaureate education, or for life in general, it is important that they be exposed to factors that define the human condition and appreciate the implications of the human record." When the college approved the set of distribution requirements specifically for engineering majors, it embraced a model of engineering education in the context of the liberal arts, and the curriculum has achieved that goal. What has been

unexpected is the influence that engineering has had on the rest of the curriculum. Let me give two examples. All of our engineers, like those at many schools, are required to do a senior design project—a year-long course in which a team of students collaborates on an actual project sponsored by an industry or government partner. The experience of doing such a project offers profound educational benefits—in learning teamwork, decision making, time management, discipline, presentation skills, as well as the fulfillment of solving a real and complex problem. Faculty in other areas of the college have looked at this model and have been discussing how to use it in disciplines very distant from engineering—art history, archival research. The second example of the impact of engineering upon other parts the curriculum I find even more surprising. Faculty have commented on the ethical seriousness that engineers bring to classes in history, or literature, or philosophy. Motivated by a code of ethical practice, they bring a sense of ethical consequence to getting the right answer in other disciplines.

It is a particularly appropriate time, I think, to broaden our concept of the liberal arts to include engineering because so many of the developments in the liberal arts that I have described characterize engineering education. It is inherently interdisciplinary, using a broad range of knowledge in science and mathematics to develop engineering solutions within a social, political, economic, and aesthetic context. It is both research and project based, providing multiple opportunities for students to solve new problems under the guidance of faculty and industry mentors. The practice of engineering is international; engineers work without borders. The goals of engineering are profoundly civic; engineers use their knowledge in service of society, addressing human needs and problems with technological solutions. It embraces sustainability as a core value; indeed, in a world of finite natural resources, we depend upon engineering solutions to conserve the resources that sustain us.

But perhaps most profound, engineering education is based on the idea of capacities. The goal of the Picker Engineering Program at Smith is to educate leaders for a sustainable world. Its three primary pedagogical objectives are leadership, adaptability, and integration. Among the defined outcomes that the program has defined as its goals are

- a conceptual understanding of engineering design fundamentals
- the ability to transform fundamental engineering principles into socially informed design
- the ability to solve problems in both a reductive and integrative fashion
- an understanding of the scientific method as well as the ability to analyze and interpret the resulting data
- competency in using engineering tools to solve problems
- the ability to collaborate effectively with a team of diverse individuals
- the ability to communicate effectively with diverse audiences
- an understanding of professional responsibility and the ethical implications of their work
- an understanding of the impact of their work on both a local and global level within the context of contemporary and historical events
- an appreciation for continual intellectual advancement

This vision of engineering represents a pioneering change. There have been calls for such a change from the Millennium Project at the University of Michigan, “Engineering for a Changing World,” and the National Academy of Engineering, in its 2020 Project. Liberal arts colleges are in a particularly good position to offer leadership in this effort. It is far too easy to focus on the challenges that liberal arts colleges face in mounting engineering programs—their relatively small size, their lack of graduate students, their lack of corporate and industry ties. But the very fact that engineering in liberal arts colleges is not a separate school with its own area of the campus, curriculum, and culture provides some important advantages. Engineering within a liberal arts college can more easily develop a curriculum that integrates the study of engineering with the traditional liberal arts disciplines. And in doing this, our colleges are in a unique position to give engineering a place among the liberal arts.