

# SYMPOSIUM ON ENGINEERING AND LIBERAL EDUCATION

MAY 9 –10, 2008 UNION COLLEGE SCHENECTADY, NEW YORK  
SUPPORTED BY THE ANDREW W. MELLON FOUNDATION



J. Douglass Klein, Dean of Interdisciplinary Studies  
Union College, Schenectady, NY

**ABOUT UNION:** Union College is an undergraduate liberal arts college with 2,200 students located in Schenectady, New York. Union has a rich history of innovation.

- Founded in 1795 by the "union" of local churches
- First analytical chemistry laboratory taught (1809)
- First architecturally planned campus in US (1813)
- Added modern languages to the curriculum (1820s)
- Added engineering to the curriculum in 1845
- Longest serving College President (Eliphalet Nott – 61 yrs)



In February, 2007 Union College adopted a new Strategic Plan which states in part:

We seek to further integrate engineering with the liberal arts. ... by maintaining strong engineering programs, by integrating engineering more solidly into the liberal arts curriculum, and by pioneering the expansion of the liberal arts concept itself to embrace the study of engineering and technology.

To this end, we have engaged other institutions in a conversation about how to integrate engineering and liberal arts. Representatives from a dozen schools with undergraduate liberal arts and engineering programs gathered for the Symposium on Engineering and Liberal Education at Union College in May, 2008. This poster presents elements from that Symposium.

## SYMPOSIUM KEYNOTE SPEAKERS

**Stephen C. Ainlay, President, Union College**

*"Re-Imagining Liberal Education in the 21st Century"*

Most challenging of all will be the development of a full-blown conception of engineering as a liberal art, not simply as one more offering on a sort of curricular cafeteria line but rather as possessing qualities that are fundamentally compatible with the goals of liberal education.

**Carol Christ, President, Smith College**

*"What is Happening in Liberal Education?"*

... 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.

**Lance Schachterle, Worcester Polytechnic Institute**

*"Why Does Engineering Fit into a Liberal Education?"*

... engineering education, as a form of liberal education, liberal knowing, and liberal action, is learning how to solve problems. The "ways of knowing the world" (another shibboleth from liberal education) which engineers distinctively use can ... solve problems in all domains where humans need solutions.

**Domenico Grasso, University of Vermont**

*"A Liberal Education and the End of Technology"*

Complex systems are systems of systems, and as much as we would like to simplify this, engineers deal with systems of systems in everything that we do. Our work interfaces with the political system, the economic systems, financial systems, and social systems. Engineers have to be able to integrate their designs into these types of systems.

## COMPARING LEARNING OUTCOMES

Liberal Education (LEAP)

### The Essential Learning Outcomes

Beginning in school, and continuing at successively higher levels across their college studies, students should prepare for twenty-first-century challenges by gaining:

#### \* Knowledge of Human Cultures and the Physical and Natural World

Through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts

Focused by engagement with big questions, both contemporary and enduring

#### \* Intellectual and Practical Skills, including

- Inquiry and analysis
- Critical and creative thinking
- Written and oral communication
- Quantitative literacy
- Information literacy
- Teamwork and problem solving

Practiced extensively across the curriculum, in the context of progressively more challenging problems, projects, and standards for performance

#### \* Personal and Social Responsibility, including

- Civic knowledge and engagement—local and global
- Interpersonal knowledge and competence
- Ethical reasoning and action
- Foundations and skills for lifelong learning

Anchorered through active involvement with diverse communities and real-world challenges

#### \* Integrative Learning, including

- Synthesis and advanced accomplishment across general and specialized studies

Demonstrated through the application of knowledge, skills, and responsibilities to new settings and complex problems

Note: This listing was developed through a multi-year dialogue with hundreds of colleges and universities about needed goals for student learning outcomes of a broad range of liberal arts education. The listing is intended to provide a common language for the assessment of liberal arts education. The listing is not intended to be a checklist of outcomes. The listing is intended to be a common language for the assessment of liberal arts education. The listing is not intended to be a checklist of outcomes. The listing is intended to be a common language for the assessment of liberal arts education. The listing is not intended to be a checklist of outcomes.

[http://www.aacu.org/leap/documents/EssentialOutcomes\\_Chart.pdf](http://www.aacu.org/leap/documents/EssentialOutcomes_Chart.pdf)

LEAP

Engineering (ABET)

### ABET (A-K) (criterion 3)

#### Program Outcomes & Assessment

Engineering programs must demonstrate that their graduates have:

- a. an ability to apply knowledge of mathematics, science, and engineering
- b. an ability to design and conduct experiments, as well as to analyze and interpret data
- c. an ability to design a system, component, or process to meet desired needs
- d. an ability to function on multi-disciplinary teams
- e. an ability to identify, formulate, and solve engineering problems
- f. an understanding of professional and ethical responsibility
- g. an ability to communicate effectively
- h. the broad education necessary to understand the impact of engineering solutions in a global and societal context
- i. a recognition of the need for, and an ability to engage in life-long learning
- j. a knowledge of contemporary issues
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Source: ABET Board of Directors, "Criteria for Accrediting Engineering Programs: Effective for Evaluations During the 2008-2009 Accreditation Cycle, November 3, 2007, p. 2.  
<http://www.abet.org/linkeddocuments/UPDATE/CriteriaandPPE001-08-09-EAC-Criteria-12-04-07.pdf>



**2008 Annual Meeting**  
Portland, Oregon  
November 12-15, 2008

Session C: *Beyond the Ivory Tower: Integrating Traditional Liberal Arts Education and Professional Preparation*



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Symposium website: <http://www.union.edu/integration/>

## IMPLICATIONS AND EXAMPLES

### A. PROGRAMS

- Dartmouth College – **Integration of Engineering and the Liberal Arts at all Levels: the AB, BE, and PhD at Dartmouth College.** Joseph Helble
- Lafayette College – **Engineering Studies at Lafayette: An Engineering Bachelor of Arts Program since 1970.** Mary Roth
- Tufts University – **Specialize and Synthesize: An Engineering Program for an Uncertain Future with Emerging Constraints.** Shafiqul Islam
- Smith College – **What do we mean by Engineering/Liberal Arts Integration?** Linda E. Jones
- Liberal Education Division of ASEE – **Evolving Perspectives on Integrating Engineering and the Liberal Arts.** Borjana Mikic

### B. COURSES AND PEDAGOGY

- Dartmouth College – **Engineering in Liberal Education and Liberal Education in Engineering.** William Lotko
- Villanova University – **Ethics in Engineering Education: Moving toward an "across the curriculum" approach.** Mark Doorley
- Smith College – **Integration throughout the curriculum: Cumulative Effects.** Andrew Guswa
- Union College – **Engineering Design in General Education.** Bill Keat
- Princeton University – **Engineering and the Liberal Arts.** Catherine Peters

### C. INTERDISCIPLINARY & TEAM INITIATIVES

- U.S. Military Academy and Union College – **Undergraduate curricula in a changing world: Engineering and the Liberal Arts and the pursuit of a sustainable future.** Christopher Conley and Jeff Corbin
- Worcester Polytechnic Institute – **WPI's Interactive and Global Undergraduate Projects.** Lance Schachterle and Richard Vaz
- Villanova University – **Villanova University's Learning Communities: Linking Liberal Arts and Engineering.** Jack Doody
- Union College – **Converging Technologies and Beyond.** Doug Klein
- Smith College – **Integration through Collaboration: Models for Multi- and Inter- Disciplinary Work.** Donna Riley