

Engineering Education for Societal Impact: The Tufts Experience

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Elements of Success

- Institutional commitment
- Alignment of university culture
- Supportive administrative infrastructure
- Individual leadership
- Assessment, feedback, and dissemination

University Commitment:

Active Citizenship as a Core Value



President
Lawrence S. Bacow

...As an institution, we are committed to improving the human condition through education and discovery. Beyond this commitment, we will strive to be a model for society at large. We want to foster an attitude of "giving back," an understanding that active citizen participation is essential to freedom and democracy, and a desire to make the world a better place

University Commitment: Tufts School of Engineering

From mission statement:

...Our goals are to educate engineers committed to the innovative and ethical application of technology in the solution of societal problems, and to be a leader among peer institutions in targeted areas of interdisciplinary research and education that impact the well-being and sustainability of society....



The Tufts Culture: Leadership in Environmental Sustainability

- Center for Environmental Management (1984)
- Talloires Declaration (1990)
- Tufts Institute of the Environment (TIE) (1998)
- Tufts Climate Initiative (TCI) (1999)
- Mystic Watershed Collaborative (2000)
- Water: Systems, Science, and Society (WSSS) (2004)

The Tufts Culture:

A Global and Interdisciplinary Focus

- The Fletcher School of Law and Diplomacy (founded 1933) - America's oldest graduate school for international relations
- International Relations – largest undergraduate major
- The Institute for Global Leadership
.....The mission of the IGL is to prepare new generations of critical thinkers for effective and ethical leadership, ready to act as global citizens in addressing international and national issues across cultures.

Educational Paradigms: Service Learning Projects

- A pedagogical tool that combines learning with a service activity
- Apply a systems approach to design
 - Recognize inter-dependence of various components
 - Include economic, political, and social/cultural issues
- Work in multidisciplinary teams
- Puts focus on creating custom solutions that satisfy constraints

International Service Learning: Senior Capstone Project on Schistosomiasis in Kwabeng, Ghana

- Six-student team developed a set of possible solutions for controlling schistosomiasis in Kwabeng
- Three major categories of interventions:
 - (1) controlling the intermediate host (snails),
 - (2) controlling the parasite population that enter the snails, and
 - (3) providing alternatives to using river water.



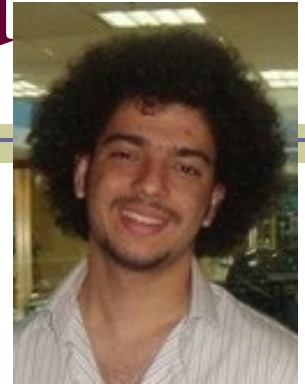
Educational Paradigms: Tisch College for Citizenship and Public Service

- Established in 2000 to support the core Tufts mission of promoting civic engagement
- Programs
 - Citizenship Curricula
 - Faculty Fellows
 - Student internships
 - Service Scholars Program
 - Civic Engagement Fund
 - Presidential Awards
 - Student Loan Repayment Assistance
 - Alumni awards, advisory council



e.g. Civic Engagement Fund

- **Green Infrastructure Project**
Malek Al-Chalabi, *Class of 2009*



Working with Groundwork Somerville, a non-profit organization, Malek researched and compiled information on the status of Somerville's green infrastructure. Malek also coordinated with a variety of government and community organizations and implemented a plan to make Somerville more environmentally friendly. A high school team also worked with Malek to improve the infrastructure and overall project implementation.

e.g. Faculty Fellow Program



■ **David Gute**

Associate Professor of Civil and Environmental Engineering

Adapted a model developed by the International Centre for Migration and Health to assess how immigrants in Somerville negotiate access to health and social services and how they perceive the environmental quality of their neighborhoods and homes. He worked with public and community based agencies in Somerville including the Somerville Department of Health and the Immigrant Service Providers Group. He involved Tufts students in the actual design and implementation of the pilot survey.

Educational Paradigms: Social Entrepreneurship Competition

- Organized and administered through the Entrepreneurial Leadership Program of Tufts Gordon Institute
- Created to encourage members of the Tufts University community to think about developing new ventures that benefit society. \$50,000 cash and in-kind services awarded to the winning plan(s)
- e.g. 2008 prizewinner: Emergent Energy Group; a wind energy consulting and development firm that designs, procures, and constructs community scale wind-farms



Educational Paradigms: *Student Teacher Outreach Mentorship Program*

- Program in the Center for Engineering Educational Outreach
- Founded in 2001 through a grant from the LLL Foundation
- Dedicated to creating partnerships between engineering students and local K-12 teachers to facilitate the integration of engineering and education.
- STOMP fellows help teachers incorporate hands-on interactive activities to teach STEM concepts
- Disseminated to other Universities: University of Hawaii, University of Colorado-Boulder, and Princeton University
- Founded an online community:
www.stompnetwork.org



Educational Paradigms: NERD girls

- An interdisciplinary group designed to give female engineering students a taste of real-life problem solving
- Student membership (now including the occasional male) from most engineering fields
- Allows students to put what they've learned into practice to help the community
- Example projects:
 - Development of a voice-activated system to give people with spinal cord injuries the ability to open and close the cages of their service monkeys
 - Bringing solar powered light to Thatcher Island



Educational Paradigms: *E*ducation for *P*ublic *I*nquiry and *I*nternational *C*itizenship

- Program of the Institute for Global Leadership
- Goal: to prepare young people to play active roles in their communities, whether at the local, national or global level.
- Each year, EPIIC's initiatives explore one central global issue:
 - 2005 – Oil and Water
 - 2007 - Global poverty and inequality
 - 2008 – Global Cities – the Urban Century
- Components include:
 - an intensive, year-long academic colloquium for both undergraduate and graduate students
 - a global research and internship program that includes multi-year integrated internships and capstone honors theses



Educational Paradigms: University Seminar



- Program proposed by Provost Jamshed Bharucha
- Competitive, proposal-based
- Seminars open to upper class undergraduates and to graduate and professional students.
- **Water and Diplomacy: Integration of Science, Engineering, and Negotiations**

“This interdisciplinary seminar -- co-taught by faculty from Arts and Sciences, Engineering, and the Fletcher School of Diplomacy -- is designed to encourage students to think across boundaries, emphasize knowledge integration, and link information to action. The goal is to combine multiple perspectives to explore solutions to water conflicts and the negotiations required to achieve those solutions. The seminar will emphasize collaborative learning opportunities, co-teaching of classes by students and faculty, and integrative activities that span disciplinary, physical, and political boundaries. Students will collectively produce a state-of-knowledge "white paper" that will be disseminated to a global audience and revised by future students and faculty. “

Educational Paradigms:

Water: *S*ystems, *S*cience, and *S*ociety

- PhD/MS/MA Program
- Partnership between 6 Tufts Schools
- Meet the growing global demand for interdisciplinary water experts
- Develop interdisciplinary research projects with significant local, national, and global contributions
- Serve as a model for integrated graduate education both within and outside Tufts



WSSS Program Components

- Core Courses: Systems, Water Science and Technology, Policy, Public Health, and Nutrition
- Research Practicum
- Integrative Seminar Series
- Internships
- Skill Workshops in public speaking, teaching, development of research and program proposals, project management and budgeting, and the ethical conduct of research.
- Interdisciplinary thesis



Conclusions

- There is no 'one size that fits all' – a blending of curricular and extracurricular programs is important
- Infrastructure and financial support must be in place
- University reward system and culture must value faculty contributions
- Important components of successful models:
 - Cross-disciplinary collaboration
 - Team experiences
 - Continuity
 - Mentorship
 - Vehicle for dissemination

.....and *Leadership is Key*



Pamela Goldberg



Shafiqul Islam

**Sherman
Teichman**



Chris Rogers



Robert Hollister



Chris Swan



Karen Panetta



Paul Kirshen and Bea Rogers



David Gute