Engineering the Future: A Workforce Perspective

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What will the world be like? What challenges will 21st century engineers face?
What kinds of skills are needed to address the challenges of the future, and how do we enable students to acquire these?
Trends that Will Shape What Engineering Students Will Need to Know and Be Able to Do

Globalization
Growing importance of water
Security challenges
Population growth
Aging populations in developed countries
Technology
Globalization
Food insecurity
Energy demands
Climate change
Poverty
Income disparity
More diversity
And the Gender and Cultural Dimensions of These
Engineering Grand Challenges

- Make Solar Energy Economical
- Provide Energy From Fusion
- Develop Carbon Sequestration Methods
- Manage the Nitrogen Cycle
- Provide Access to Clean Water
- Restore and Improve Urban Infrastructure
- Advance Healthcare Informatics
- Engineer Better Medicines
- Reverse Engineer the Brain
- Prevent Nuclear Terror
- Secure Cyberspace
- Enhance Virtual Reality
- Advance Personalized Learning
- Engineer the Tools of Scientific Discovery
Engineering Grand Challenges

www.engineeringchallenges.org

- Energy
- Water
- Climate
- Sustainability

- Security against Human and Natural Threats

- Improve Medicine and Healthcare Delivery

- Expand and Enhance Human Capability And Joy
Work with People in Other Fields
Work with Teachers and Out of School Educators
Work with People in the Community (Engineering Extension)
Written, Oral, and Digital Communication with Peers and Decision Makers
The Educational Value of Diversity
(Cultural Competence)
Global Awareness
Teamwork (Incorporating Gender and Cultural Dimensions into Design)
Universal Design (e.g., Design for an Aging Population)
Products across Borders
“Small” Technologies
Work with Policy and Politics
What Kinds of Experiences, Opportunities to Practice These?
Overstuffed Curriculum

- More is not more.
- Accreditation and learning that is not central to daily life.
-重复的主题，没有发展更广泛的理解。
- curiosity and questioning often eliminated.
- Lectures not practice.
- places instruction over learning.
- Favorite Topics
  - doesn't capture attitudes, observations, and reflections about doing science.
  - Overhead vs. time spent on learning.
- Overloaded content vs. time spent on technical terms.
- Unnecessary subtopics vs. skills
- Heavily dependent on textbook vs. living laboratories.
- Core:
  - Heavy on technical terms.
  - little focus on critical reflection.
- Electives:
  - state/regional needs.
  - technology not integrated into the STEM learning activities.

Projects
TEAMING WITH IDEAS

Engineering students go global, designing solutions while competing for cash.

Dorcel Torres almost left engineering behind when she began graduate studies in soil science at Cornell and plunged into research on biochar. This high-carbon, low-ash black dust, the result of incinerating plant waste, has the potential to boost crop yield in poor countries where farmers can’t afford fertilizer. It also traps carbon dioxide, helping to curb climate change. And because it can be made from all manner of organic material, it spares forests. But when Torres asked, “How do you expect farmers to get biochar?” no one had an answer. So she set out to find one, resurrecting skills acquired as a chemical engineering major at the University of Puerto Rico, Mayaguez.

That simple but crucial question “how?” captures what drives Torres and other contestants in the biennial Mondiologo Engineering Award competition. From looking for ways to stop sewage floods in an urban slum to bringing modern diagnostic techniques to rural clinics, these young competitors strive to design functional, environmentally friendly solutions to pressing problems in some of the world’s poorest regions.

Sponsored by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the German automaker Daimler, the contest aims to nurture cross-cultural collaboration. It requires student teams from developed countries, like the United States, Britain, Germany, and Singapore, to join with teams from developing countries, mostly in Asia, Latin America, and Africa. Past Facebook, part distance-learning challenge, and part cultural leveler, Mondiologo also serves as an international virtual meeting ground for the technologically inclined.
Focus on how we teach, rather than what we teach (centered on the learner, context is critical)

Imagine “Engineering the Future” as an interdisciplinary course for non-majors?

What would it take to recruit “undecideds” to majors or minors?