Educating the Humanitarian Engineer

Kevin M. Passino
The Ohio State University

Outline

- Volunteerism/humanitarianism is required for engineering professionalism?
- Universities are responsible for development of the profession
- Educating the volunteer/humanitarian engineer is a university responsibility:
  - **Strategy 1: Expand ethics and professionalism treatment**
  - **Strategy 2: Hands-on volunteerism via a student organization**
  - **Strategy 3: Humanitarian Engineering course/minor**
- Concluding remarks

Strategy 1: Expand Ethics and Professionalism Treatment

- Course topical outline (professionalism, codes of ethics, moral frameworks, eng. as social experimentation, safety/risk, case studies, workplace, honesty, environmental ethics, global issues)
- How to augment typical textbook treatments…
- Profession: "Pursuit of a learned art in the spirit of public service" (ASCE)
- Webster's Dictionary: "... a kind of work which has for its prime purpose the rendering of a public service."
- Public service is a critical part of being a professional!

Two routes to public service

- Employment + Service to Profession: Competence ("go the extra mile" to do good work), service to colleagues, service to profession, etc.
- Community service: Local/international service, charitable organizations, disadvantaged groups, non-profits, educating public about profession, etc.
- Are both *required*? For the profession, yes, <u>for the individual not always</u>.

Codes of Ethics

- NSPE:
  - **"Hold paramount the safety, health, and welfare of the public" (engineers must help the poor?)**
  - **"Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations."**
- Role of "service" in codes, comparative:
  - **NSPE:** "Engineers shall seek opportunities to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community."
  - Others with *similar* statements: ASCE, ACM/IEEE Software Eng. Code
  - Others have *weak/no* statements: AIChE, ASME, IEEE
- We need changes!
  - ***Encourage, support, set group expectations,…***
  - ***Must prominently state our ideals!***

Comparative professionalism

- AMA: “A physician shall recognize a responsibility to participate in activities contributing to the improvement of the community and the betterment of public health.”
- ABA: “... Every lawyer has a professional responsibility to provide legal services to those unable to pay. A lawyer should aspire to render at least (50) hours of pro bono publico legal services per year.”
- Is there a pervasive “pro bono” spirit in engineering???
  - Existing student volunteer activities (e.g., SWE, Tau Beta Pi, etc.)
  - Existing practicing engineers’ volunteerism (tutoring, etc.); identified as engineers? Do engineers/others view their services as essential?
  - We need “engineering clinics” as infrastructure for volunteer engineers
  - We need expanded “corporate citizenship programs” in corporations

Moral frameworks

- Utilitarianism, rights/duty ethics, virtue ethics all support volunteerism?
- Community-oriented version of self-realization ethics:
  - **Promote professional development via integration of work and personal integrity**
  - **Company supports engineer in service, engineer develops loyalty to company**
  - **Need strong corporate citizenship programs!**

Global Issues, World-Wide Communities…

- Community design constraints (must teach this!)
  - **Know needs of community, get community involved, use local talent**
  - **Appropriate technology, technology transfer, safety**
  - **Cost, maintenance, and improvement**
- Environment (sustainable development)
- Cultural exchange (efficiency vs. relationships)
- Globalization (learn about the competition)
- We need to educate “Global Citizens”

Strategy 2: Hands-On Volunteerism Via a Student Organization

- OSU Engineers for Community Service (ECOS)
- Founded 2004, related organizations:
  - **Engineers Without Borders (EWB), USA, Univ. Colorado, Boulder**
  - **Engineers for a Sustainable World (ESW)**
  - **Engineering Projects in Community Service (EPICS), Purdue University +**
  - **ETHOS, Univ. Dayton; Engineering World Health, Duke Univ.**
  - **Chapters + others…**
- Prime determinant of success - Students

Mission

- Engineers for Community Service (ECOS) promotes life-long professionalism via educational experiences in the uses of engineering skills for local and international community service projects.

ECOS is a College-Wide "Umbrella Organization"

- Advisory Board with faculty and staff
- Seminar series (e.g., service project examples)
- Multiple parallel projects in progress across College of Engineering:
- ECOS web: http://ecos.osu.edu/ for project descriptions
- Key challenge: High-tech vs. "grunt work"

Volunteerism project ideas

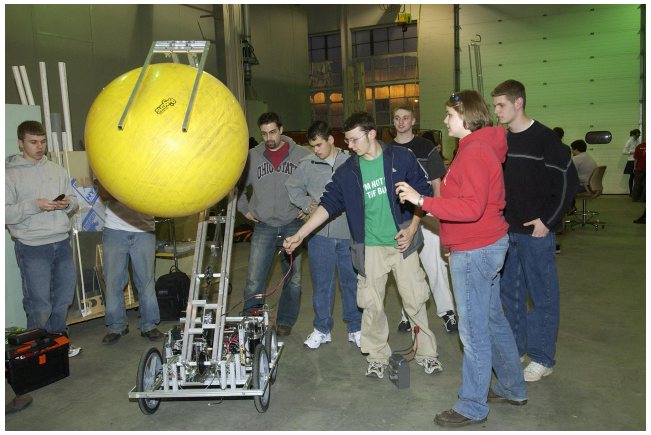
- Drinking water filtration, waste treatment (low cost, effective yet without adverse environmental impact)
- Agriculture (improve yield, irrigation)
- Low-cost housing (local materials, portability for refugees)
- Electricity generation, wind and solar power, solar cooker, lighting (renewable energy sources, low-cost solutions to basic needs)
- Computer technology (education support, career-development)
- Communications technology (promote democracy, market price information)
- Medical technology, telemedicine (promote healthcare access and quality)

Projects

- Columbus/Domestic:
  - **Wonders of Our World (WOW): Science education for K-5**
  - **TechCorps, Ohio: Technology for disadvantaged schools**
  - **OSU FIRST robotics**
  - **Notre Dame Alumni Club Computer Software Education Project involvement**
  - **Explorer Post**
  - **Wheel-chair ramp project**
  - **Retirement home, computer education project**
  - **Wheel chair ramp project**

WOW program students

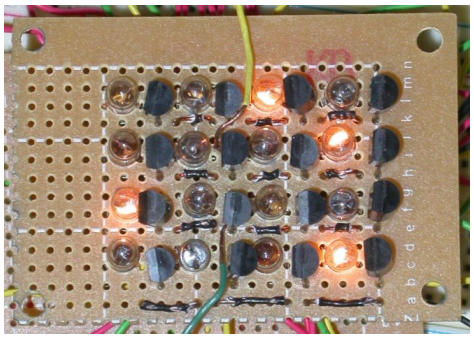
OSU engineering students with local high school students working on a robot



Projects

- International (completed):
  - **Low-cost laboratory development for higher-education**
  - **Casa de Maria y el Niño orphanage, computer donation and education, Medellín, Colombia (Summer 2004)**
  - **Design courses in low-cost housing and drinking water purification**

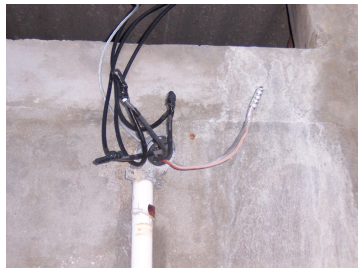
A low-cost control system experiment



Children at Casa de Maria

OSU Environmental Design Team takes first place at WERC competition!

- International project (Spring Breaks since 2005):
  - **Montaña de Luz, HIV/ AIDS orphanage in Honduras**
    - Pre-project trip completed Summer 2004
    - Web page
    - Electrical wiring
    - Administrative computers
    - Children's computer lab
    - Computer education
    - Assess communication problems
  - **Also Choluteca project**



Children at Montaña de Luz

Strategy 3: Humanitarian Engineering Curriculum

- Humanitarian Engineering Minor (to be proposed)
  - **For all majors in College of Engineering**
  - **3-4 courses in language, culture, international economics/business, politics, development/poverty, sustainability/environment**
  - **Integrative course "Humanitarian Engineering"**
  - **Project courses local, international (design+trip)**
- Student interest:
  - **Humanitarian Engineering Scholars Program (live in dorm together, talks, etc.): 150 students/yr**
  - **ECOS, EWB, ESW, etc. (projects/trips since 2005)**

Humanitarian Engineering (proposed course, Spring 2014)

- Week 1: Status of poverty and development world-wide, UN Millennium Development Goals, Technology and engineering in development
- Week 2: Social justice as rationale and goal for humanitarian engineering, Social justice, religious perspectives
- Week 3: Social justice, religious/secular
- Week 4: Social justice, secular perspectives

- Week 5: Social justice and engineering ethics
- Week 6: Development strategies
- Week 7: Development strategies, implications for engineering for development
- Week 8: Engineering for community development
- Week 9: Extreme design constraints, “appropriate technology”

- Week 10: Environment, pollution and climate change, environmental ethics, sustainable ("cradle-to-cradle" or "life-cycle") design
- Week 11: Cultural impact on engineering business, engineering ethics, technology design
- Week 12: Design implementation and iteration, reasons for failures of projects, examples

- Week 13: Humanitarianism and the university: Research, curriculum, student organizations, inter-university collaboration for development, project trips, up-coming OSU project trips
- Week 14: Humanitarianism and the engineering enterprise: Technology policy, technology to promote social justice, technology for the poor, technology transfer, “race to the bottom”, impact on engineering (e.g., sweatshops), weapons development/social justice

Comments on Course

- Part of “service-learning” trend (across university)
- “Theory” part of theory-practice of humanitarian engineering
- 3 credit hours, 3 lectures/week, offered annually
- Prerequisites: Undergraduate/graduate engineering majors, architecture majors, first eng. course
- Assignments: Weekly home works, book report, midterm/final paper design project (integrative)
- Working already to put the course on-line

Wider University Program Development

- Other related curricular programs at:
  - **Univ. Colorado, Boulder**
  - **Colorado School of Mines**
  - **Pennsylvania State University**
  - **MIT (D-Lab)**
- Development of other programs?
  - **Other US programs highly likely to develop (globalization + student interest are drivers)**
  - **Best: Humanitarian Engineering courses/programs in developing countries, in the local language, given from a local perspective, using local expertise.**

Humanitarian Engineering Program Here?

- I volunteer to teach a short course here
- Desired audience:
  - **Professors (to teach the course here), Dept. Chairs/ Deans (who approve/support teaching)**
  - **Practicing engineers (lead projects), students**
- Desired outcomes:
  - **Regularly offered course on humanitarian engineering, humanitarian engineering minor, and/or use the on-line course?**
  - **Projects:**
    - Professors, practicing engineers lead
    - Involve OSU? Teach us problems, collaborate on solutions

Will such a program succeed?

- Are your universities directed to serve your country? Does university funding (e.g., from the government) depend on that?
- University/professor/staff/practicing engineer support for humanitarian engineering is critical (part of duties?)
- Student interest drives curricular success! If you offer a course and no one signs up, it fails!
- Student perspective on an engineering career:
  - **Profit (support family, make company money)**
  - **Humanitarian engineering career (support family? Jobs? NGOs? Government?)**
  - **Do both? Have job for career/profit, plus in free-time do humanitarian engineering?**

Concluding remarks

1. Claim 1: Individual (group) professionalism *is* (is not) possible without volunteer service to the community
2. Claim 2: Universities are responsible for development of the profession and educating the volunteering engineer
3. Claim 3: Humanitarian Engineering is an important and growing field to support professional volunteerism
4. Claim 4: Critical need for infrastructure to support the volunteer engineer (university, industry, government)

- Reference:
  - **K.M. Passino, "Educating the Humanitarian Engineer" Science and Engineering Ethics Journal**
  - **Paper at: http://www.ece.osu.edu/~passino/professionalism.html**