

December 2013

**Special points of interest:**

- Highlights of our guest lecture series by our HE program director
- Experience in international development by our community partner: Edge of Seven (E07)
- Life and work experiences from the field: on being a humanitarian engineer
- Highlights of the pilot class **Engineering Projects That Matter: perspectives from students, instructor/facilitator**
- New course offering **Spring 2014: Human Centered Problem Definition**

“The Humanitarian Engineering minor presents a unique opportunity for our undergraduates to explore their *wholeselves*. Especially with exposure to broader perspectives, further than their engineering core, this opportunity leads to pathways for a richer experience and preparation for a great engineering career.”

Dean Ramona Graves
(CERSE) *

*College of Earth Resource Sciences
and Engineering

The Humanitarian Engineering Program Newsletter Colorado School of Mines

"To Be Humanitarian or Not to Be? To Get Paid Lots or Not? To Get Tenure or Not?" Apparently These Are Not the Right Questions

By Prof. Juan Lucena, Director

In Fall 2013, the Humanitarian Engineering (HE) Program sponsored six career workshops and lectures to begin answering key questions lingering in students' and faculty's minds about the value of HE in an engineer's education and future career. What are on students' minds when searching for HE jobs? Getting a high salary in a traditional job or working on something I feel very passionate about but getting paid less? Can I go from a traditional engineering career into one centered in humanitarian engineering practice? If so, how? What do EWB membership and volunteer work mean for me when seeking employment? How do corporate employers value my EWB work and other engineering service related experiences?

To begin answering these questions, the HE career series opened with a highly interactive workshop where students explored the challenges and opportunities in finding HE-related jobs through diggernet and the career center. After realizing that perhaps they need to be more strategic about how they search for and present themselves to potential employers, students learned

from **Jean Manning-Clark**, Director of CSM Career Center, how to identify potential employers and job positions, in both the private and public sectors, that would allow them to remain committed and work in HE-related activities and projects.

In October, Professor **Amy Javernik-Will** (Civil, Architectural, and Environmental Engineering Department at CU-Boulder) provided a great example of how an engineering academic career can be effectively directed towards analysis of community reconstruction after disasters and how HE practitioners can use these analyses to build community resilience prior to disasters and enable more successful recovery following disasters. In short, Professor Javernik-Will showed that one can successfully be on the tenure track and devote one's career to HE.

Next Dr. **Jessica Kaminsky** (Department of Civil and Environmental Engineering, University of Washington) presented her own career as an example of an engineer who can work for for-profit companies that allow flexibility to volunteer (CH2MHill), create and EWB professional chapter, and then pursue PhD research on the social sustainabil-

ity of water projects in developing communities. Dr. Kaminsky demystified the idea that there are no jobs for engineers in community development. We just need to know where and how to look for them. She informed our students about the costs and benefits of development work, how to prepare for this work from within and out of the curriculum, how to build skills and experience and how to get funding to pursue your dreams. (Scan the left corner QR code for her video and presentation—red.)

Later, **Kaitlin Litchfield** (PhD student in the Mortenson Center for Engineering in Developing Communities, CU-Boulder) presented her research on what EWB experience means to both engineering students and professionals, highlighting the challenges that engineers find when trying to balance their passion and engineering work. For many, EWB involvement gives them a meaningful outlet that allows them to continue their engineering careers. — *Continued in page 3*



Edge of Seven (Eo7) fuses travel with service, sparking opportunities for personal and global development. We engage passionate volunteers in our mission to create access to education, economic, and health opportunities in the developing world. We offer volunteers the unique chance to go beyond their comfort zones and work closely with people who possess different histories and perspectives on our world. driven, community-focused and sustainable.
(Sarah Andrews, Eo7 Executive Director)

“We presented this solution to village leaders, who agreed to the new method after careful discussion.”

Building collaboratively with communities in the developing world: Edge of Seven and Earthbag Construction in Nepal

By Travis Hughbanks, Lead Designer and Architect with Edge of Seven

In 2011, Edge of Seven, a Denver-based nonprofit that creates educational access in the developing world, began construction on a higher secondary school in a remote area of Nepal’s Everest Region using the earthbag construction method and working alongside local community leaders and a Nepalese NGO partner.

The project arose as community leaders in the village of Khastav struggled to provide adequate infrastructure for all of the students in the region to attend high school. Due to the lack of available materials, financial resources, and skilled laborers in Khastav, Edge of Seven worked to find a new design solution.

Earthbag construction fit the bill, as it was cost-effective, earthquake-resistant and drew upon local materials and non-skilled labor. We presented this solution to village leaders, who agreed to the new method after careful discussion. While they had many questions

about its feasibility, they liked the fact that it could be easily implemented and would provide more structural stability than traditional stone masonry. The idea that the soil you excavate when leveling the site eventually becomes the walls of the structure resonated with the community as this type of resourcefulness and logic is inherent in rural Nepali culture. Earthbag construction was easily understood by skilled and unskilled workers alike as it is a masonry based construction method not that dissimilar to traditional stone. Earthbag construction also had the added benefits of being repairable and replicated by local laborers.

The project was completed in the summer of 2012. Earthbag was such a success in Khastav that the community has asked Edge of Seven to support their need for additional classrooms, which we will be building in the fall of 2013 and spring of 2014. By listening to and working with local com-

munity leaders, we are ensuring this project addresses the real needs that exist in the region and will be sustainable over time, as it has the full investment of the village residents who retain ownership and will see to its maintenance for years to come.

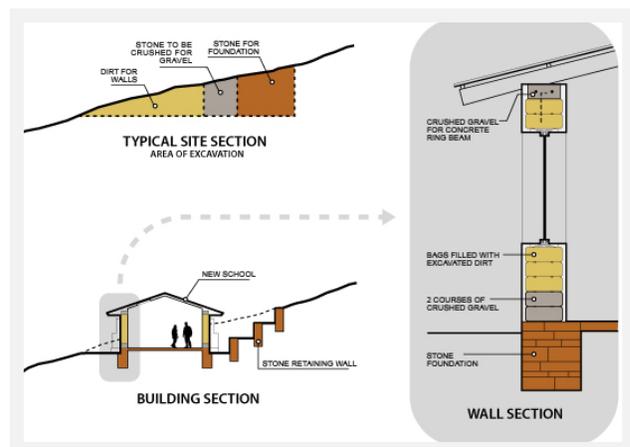
To learn more about Edge of Seven, visit www.edgeofseven.org and read about the project in Khastav on the organization’s blog at <http://edgeofseven.wordpress.com>



Picture on right: Earthbag Diagram

Foundation excavation on a typical site yields large stones, small stones, and dirt. With earthbag construction everything that is excavated is used to build the structure. The large stones are used for the foundation, small stones are used for gravel in the first two courses of bags to prevent water from wicking up into the wall, and the dirt is the fill for the upper bags to create the walls.

(Eo7documentation)



Unlocking the Human Side of Engineering

By Collete Van Straatten, May 2012 HE Graduate

The Humanitarian Engineering (HE) minor was the final driver for my decision to attend CSM. The human side of an engineered solution has always interested me and drew me to the program and school. With just under two years of industry experience behind me, I could not be happier with my alma mater and especially with my minor. The HE minor offers something so unique yet imperative to its students: a human perspective to engineering. Learning about energy and society, community and development, and systems and stakeholders provides students with skills such as problem definition, stakeholder identification, and solution-based thinking. HE sets its graduates apart.

To me, HE started as a way to apply engineering to specific solutions such as housing, water supply, and waste management worldwide, with consideration of cultural and economic challenges. Enrolled in the program my views evolved to realize that including the humanitarian dimension makes engineering complete for all interest groups, including marginalized groups

who are seldom served by engineering.

In my current job as an Environmental Engineer for an exploration and production company for oil and gas, I use tools daily that I learned in the HE minor. I deal regularly with water issues and regulatory agencies surrounding oil and gas extraction, making stakeholder identification and communication a crucial component of business. Understanding how to engage communities effectively and explain technical information to non-technical individuals is something I do daily. In dealing with property owners, enforcement officials, community leaders, and legislators the human side of the oil & gas business is always present in my work.

Every well site is a micro-cosmos of interactions between technical and social systems such as roads, pipelines and machinery that can affect surrounding neighbors with impacts such as sound, traffic, spills, and light. In oil & gas companies, there are entire departments dedicated to deal with these impacts. As an engineer with a humanitarian back-

ground, I understand that there is more to the story than equations that relate water, steel, pressures, and volumes and this makes me better at my job.

After working in oil & gas for almost two years, I see how all industries can benefit from graduates of the HE minor. Paired with the strong engineering background that CSM is known for, a HE minor with its focus on engineering in real communities can provide its graduates with a much more complex perspective to hit the ground running in any industry. Stakeholder identification, and their inclusion in engineering problem definition, will help graduates build strong engineering solutions and give them the social license to operate.

I couldn't be happier to see the HE minor at CSM thriving as it produces engineers that have the capacity to see both the technical and human sides of engineered solutions.



Picture from <http://www.env-eng.com/>

“In my current job as an Environmental Engineer for an exploration and production company for oil and gas, I use tools daily that I learned in the HE minor.”

To Be Humanitarian or Not to Be? continued

Finally, Greg Rulifson (PhD student in the Mortenson Center for Engineering in Developing Communities, CU-Boulder) shared his research on how corporate employers value students' HE-related curricular and EWB-like service activities. His data clearly shows that these activities give engineering students a significant leg up over other students with similar grades. More

specifically, these activities give students the opportunity to develop skills (like project management, team work, budget, designing with scarce resources, etc.) early in school and, perhaps more importantly, to show that they can commit to causes larger than themselves.



Lecture by Dr. Amy Javernick-Will

(HE documentation)

“Students in the course are learning human-centered design practices and applying their technical training to address this complex socio-technical challenge.”

Many thanks to our EPTM students for your enthusiasm, dedication, and hard work:

- Laura Brigham
- Joelle Brunvand
- Israel Clark
- Nicole Davis
- Becca Ferguson
- Zach Idziak
- Justin Loeffler
- Doug Nettles
- Lauren Sepp

**Jered Dean is Teaching Associate Professor at the College of Engineering and Computational Science (jdean@mines.edu)
** Mirna Mattjik is Program Coordinator for the Humanitarian Engineering Minor Program (mmattjik@mines.edu)*

Engineering Projects that Matter (EPTM)

By Jered Dean*, Instructor and Mirna Mattjik**, Facilitator for the EPTM class Fall 2013

The Humanitarian Engineering Minor Program has been fortunate to collaborate with many community partners, one of them is the recipient of the 2013 IEEE (Institute of Electrical and Electronics Engineer) Global Humanitarian Engineering Project award, **International Development Enterprises** (iDE).

iDE works with rural farmers around the world on dry season farming practices. Their work has significantly impacted the income and wellbeing of rural farmers in Burkina Faso and Northern Ghana (two of their areas of focus). Through the use of drip irrigation, treadle pumps and dissemination of dry season farming best practices iDE's customers can double, or even triple, the growing season.

However, post-harvest food loss for developing world's farmers can be as high as 40% through the process of harvest, handling, threshing, drying, storage, and transport. iDE's farmers need better tools to extend the life of their crops until they can be sold.

This semester CSM students are working closely with iDE to explore possible solutions to this challenge as part of the Engineering Projects that Matter (EPTM) course. Students in the course, two of which are HE minors, are learning human-centered design practices and applying their technical training to address this complex socio-technical challenge. Students are interacting directly with country directors and engineers at iDE to identify opportunities for engineering interventions. Thus this class is an impetus of the *engineering by doing* initiative starting at CECS.

Students kicked the class off with a bang, through rapid prototypes of possible solutions as their first assignment. Given \$20 and one week, pairs of students prototyped concepts ranging from tomato drying racks to underground crop storage cellars. These

prototypes were presented directly to iDE and used as the starting point for discussing cultural and technical constraints for the problem.

Further along the class students managed to identify the needs of the farmers in a contextual manner. They were able to see the challenge as a not “for help” issue, putting down barriers and listening very intently to the stakeholders involved. Hence, seeking for both social and technical solutions through rich engagement; and leveraging iDE as the direct connect to the farmers. (See the article on students' testimonials)

In addition, EPTM is one of the first classes to take advantage of CSM's partnership with the Posner Center for International Development. The Posner Center is home to over 40 NGO's and social enterprise organizations and is the epicenter of global community empowerment, iDE included. CSM students in the College of Engineering and Computational Science' (CECS) Senior Design teams and Engineers Without Borders members are also using the CSM's working space in the center, to engage with these organizations and learn from their experience.



Picture on top: EPTM students at the Posner center

Picture on left: First prototype challenge done by Laura Brigham, Lauren Sepp and Nicole Davis

(EPTM documentation)

EPTM Students' Testimonials:

Nicole Davis and Doug Nettles (HE Minors , Mechanical Specialty, CECS)

As much as it is convincing to have faculty talk about the EPTM class, the students' testimonials are the best way to display the energy, enthusiasm and dynamics of this class. Here are testimonials from HE minor students who were also part of the pilot group for EPTM, Nicole Davis and Doug Nettles. As background, both are Mechanical Specialty Seniors from the College of Engineering and Computational Science (CECS).

Working with iDE

Nettles who is graduating this Fall, mentioned that working with iDE "has been wonderful". To which Davis refers to iDE as an "amazing partner". Davis noted the fact about their accessibility and openness on sharing resources – even connecting with experienced country directors was possible. Nettles has especially mentioned the learning experience and "the different ways they think", which is vital to engineering education. Not to mention the vast amount of knowledge iDE has about the area and the people who live in it.

Davis commented about how much she connects with iDE's mission, that "the project has more importance to me than any other project I have worked on". Related to this, Nettles mentioned that he aspires to have a job like theirs (iDE—red.) that can possibly make an impact on the world.

Preparation for life outside CSM

Among our peer institutions, CSM graduates are best known for their strong engineering skills. For this class, Nettles and Davis spoke to their unique experience on how they compile their engineering skills and begin to put them into a framework on building effective solutions. As Davis stated, "I am able to look at the tools that three previous years at Mines have given me and choose the ones that will help me find a solution."

The true state of an open ended problem, the involvement of our community partner and the broad requirements on the deliverables allow for genuine excitement. Noted by Nettles in the following statement: "We were given a challenge by iDE and they've actually fully trusted us. We researched and researched, and it's not like we've been given breadcrumbs to follow." Similarly, Davis mentioned "...the freedom that has been given to us students is similar to what I would expect in the workplace." And more strongly about trust, Davis said, "This feeling of trust between the students and the instructors has caused me to work harder than in a lot of other courses because I don't want to let them (or the farmers in Ghana) down, in the same way that I wouldn't want to let my boss or the customers down in life outside of Mines."

Favorite part of the project

Davis mentioned the excitement of having to work on the \$20 prototype and creative ways to convey ideas through brainstorming with sticky notes and (now) a favorite site for collaboration called <http://Mural.ly> introduced by Professor Dean. Also, *failure is an option* and becomes a fact that was embraced happily by both Davis and Nettles. Perhaps not failing in a literal sense, but better framed by Davis as: "Having the freedom to fail but the challenge to succeed has shifted my thinking and allowed me to focus on the needs of the final consumer (the farmer) rather than the grade I will receive in the class" Nettles had a stronger opinion on the same issue: "We took this big problem, something seemingly impossible, and learned everything we could. Then we managed to narrow down all our knowledge into one solid answer. We actually found something that could work! If this was a test everyone would fail! There is no answer!"

Further, applauding the human-centered design methods, Davis recalled how Professor Dean coaches students to *first* focus on other than the technical solutions. Decentering technology is a major breakthrough in her engineering experience, and she enjoyed it very much.



CSM signage on the Welcome Board at the Posner Center

(EPTM documentation)

"Having the freedom to fail but the challenge to succeed has shifted my thinking and allowed me to focus on the needs of the final consumer (the farmer) rather than the grade I will receive in the class."



Leslie Light
(Self documentation)

“I have learned that whether you are working in a non-profit, for-profit, or other type of organization, there are ample opportunities to improve the conditions of society and the human experience, if you seek them out.”

Words of Wisdom from Leslie Light:

Humanitarian Engineer, iDE Project Manager and Instructor for Human Centered Problem Definition (Spring 2014)

The degree of “humanitarianism” has waxed and waned repeatedly throughout my 20 year career, though through it all, I’ve kept my goal of having a job with purpose, and of being able to contribute to improving others’ lives.

I studied product design engineering at Stanford, graduating with the hope of joining an appropriate technology organization. Without much practical experience, this proved difficult, so I chose a job in India, first redesigning steam engineering components and then designing new thermal flasks for the Indian chai-drinking market. Two years in India gave me a thorough experience in the implications of designing for and serving a different culture. After-

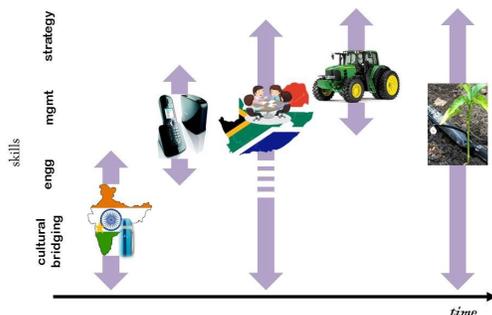
wards I moved to the Silicon Valley, working in a product design consultancy as a project manager and contributing engineer. After two years there I went to Philadelphia for an MBA, joining Deere & Company upon graduating. I worked at Deere for nearly a decade, building skills in management and strategic planning.

After nine years, I felt the pull to a more humanitarian job, and was fortunate to find work at iDE, an international non-profit headquartered in Denver. I work in the technology team, as an engineer, project manager, and grant writer. The degree of humanitarianism in my current job is quite high now, but I’ve found that the skills and experiences I’ve accumulated through my “non-humanitarian” jobs have given me the flexibility to

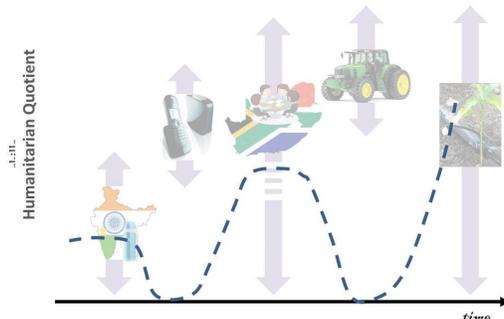
do what needs to be done in this job, to affect any amount of impact.

During the years in for-profit companies, I have worked with many inspiring people who’ve brought humanitarian elements into their “non-humanitarian” roles, whether it’s elevating the corporate position on global matters, establishing factory recycling programs, or promoting tolerance in otherwise difficult environments. I have learned that whether you are working in a non-profit, for-profit, or other type of organization, there are ample opportunities to improve the conditions of society and the human experience, if you seek them out. (Hence the relevance of the HE quotient below—red.)

My career, in a nutshell



My career, in a nutshell



Leslie's HE Quotient throughout her career

(Self documentation)

Human Centered Problem Definition EGGN498

New Course Offered in Spring 2014

Do you want an active learning experience that will intrigue your senses, not just something you read out of a text?

Do you want to feel and experience the intensity of designing for people?

Do you want to be able to methodically deep dive into the crux of an engineering problem and solve what matters the most?

Do you know when and how to call off your project if consciously you know it is going nowhere?

If you answered yes to any of these questions, you might be interested in the Human Centered Problem Definition course, offered in the Spring 2014 semester. There are no prerequisites, except having an open mind and great attitude in active learning.

The course will be taught by Leslie Light, who is an experienced engineering professional in the development field. The goals for this class are to identify, define, and begin solving real problems for real people, within the technical/social ambiguity that surrounds all engineering problems.

The focus of this course will be problems faced in everyday life, by people from different backgrounds and in different circumstances. There will be exercises that will prepare you to thrive/prosper in your future workplace, and be a capable/adept engineering leader.

In the end, we want students to recognize design problems around them, determine whether they are worth solving, and employ a suite of tools to create multiple solutions.

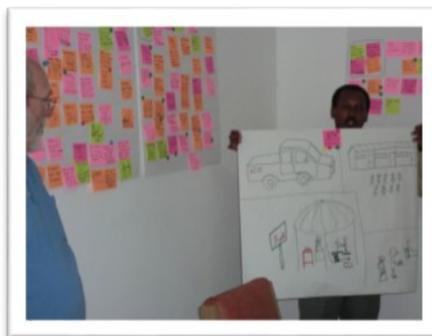
This is also a pilot course, but is attended for the foundation course preceding Engineering Projects that Matter. The class will meet Tuesday and Thursday 2:00 pm –3:15 pm

“In the end, we want students to recognize design problems around them, determine whether they are worth solving, and employ a suite of tools to create multiple solutions.”



Both photos are from an Innovation Workshop in Ghana

(IDE documentation)



Acknowledgement

FALL 2013, ISSUE 2

Visit us on the web: www.humanitarian.mines.edu



Special thanks to all of our newsletter contributors, which had made this Fall 2013 newsletter an essential publication and communication tool for the Humanitarian Engineering Minor program. Our sincere thank you to our CSM students, also other supporting entities on campus. And we owe it to our community partners who have made our program more vibrant and visible – we value our partnership very much! We hope everyone will enjoy a wonderful, joyous, and safe holiday. See you in the new year, 2014.

Contact jlucena@mines.edu or mmattjik@mines.edu for further questions or comments about this newsletter.

A word cloud of terms related to humanitarian engineering. The words are arranged in a roughly circular pattern and vary in size and color. The colors include shades of red, brown, and grey. The words are: Anthropology, Design, Sustainability, Engineering, Assistive, Accountability, Community, Social, Participatory, and, Humanitarian, Sustainable, Technology, Partnerships, Justice, Energy, Water, and Listening.

Anthropology
Design
Sustainability
Engineering
Assistive
Accountability
Community
Social
Participatory
and
Humanitarian
Sustainable
Technology
Partnerships
Justice
Energy
Water
Listening