Creating A Global Solutions Curriculum

Miss Megan Elizabeth Sharp, IUPUI School of Engineering and Technology

Megan received her Bachelor of Arts in Political Science from Ball State University in 2007. The area of focus was International Studies, and the degree was accompanied by minors in International Resource Management and Peace Studies & Conflict Resolution. Following her undergraduate work, Megan attended Taylor University and earned a Masters of Environmental Science in 2009, following an overseas internship with the ACTS Group of Institutions in Bangalore, India. Megan's academic and personal pursuits have provided exciting opportunities to gain international experience in Germany, India, Bangladesh, Guatemala, and Mali. Currently, Megan is working with an environmental consulting firm in Indianapolis and leading the first Global Solutions course at IUPUI. She looks forward to future opportunities to serve others in the field of international development.

Mrs. Alison L. Stevenson, Indiana University-Purdue University Indianapolis

Alison studied at Indiana University Purdue University Indianapolis for her undergraduate career and complete her Bachelor of Arts in German, Minor in International Politics, and Certificate in International Leadership in 2005. Upon graduation, she worked in the manufacturing industry for 5 years coordinating marketing between the United States and several European countries. In 2010, Alison returned to academia in the School of Engineering Technology. She is currently pursuing a Master of Science degree in Literacy, Language, and Culture Education through the School of Education at Indiana University. She will complete her degree in August. She teaches a course titled Discovering Technology, and looks forward to future teaching opportunities.

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As the world's less developed nations join the development race, demand will be high for engineers trained in a range of development projects. Engineers will be needed to install water delivery and sanitation systems, roads, bridges, dams, utility infrastructure and much more. The scale of such projects will range from serving rural communities of a few hundred people to rapidly-growing urban centers of several million people. The success of these projects will depend not only on the soundness of the structures built, but on the soundness of the engineer's relationship with the community and his understanding of its culture, governance, and inherent systems. These disciplines, however, are rarely included in today's engineering programs. Students may graduate with a strong grasp of the technical knowledge necessary to pursue a career in engineering, but little awareness of how engineering projects impact the social fabric of the community in which they are erected. Many students, too, enter engineering, technology, and construction programs with little knowledge of the global applications their degrees can offer. The Global Solutions curriculum at Indiana University Purdue University of Indianapolis (IUPUI) is designed to expand student outlooks by bringing together students of various academic and cultural backgrounds in a multidisciplinary program that explores not only the technical solutions to global development issues, but the social and cultural context in which such solutions must be established.

The Global Solutions Curriculum will be comprised of three successive courses: Global Solutions for International Development, Global Solutions Design, and Applied Global Solutions. The first course in the series, currently being instructed in IUPUI's Engineering Technology Department, looks at a broad range of development issues. The second course, Global Solutions Design, will bring the broad ideas of the introductory course into sharper focus, as students apply the concepts to a specific community to meet a specific need. Finally, Applied Global Solutions will give students the opportunity to experience first-hand the role of the development worker, as they visit a developing community and work side-by-side with local community members to meet a felt need.

Student Population

According to IUPUI's Office of International Affairs, international students represent countries from five different continents, and the vast majority of them come from Saudi Arabia through a scholarship from the Saudi Arabian Cultural Mission.

The international diversity at IUPUI provides a beneficial learning experience; one that this curriculum attempts to capitalize upon. Furthermore, when our international population is exposed to this series of courses, they will have the opportunity to bring this message home with them, expanding upon the potential sphere of influence of this curriculum.

Our local students also benefit from this multicultural course structure. In the School of Engineering and Technology, we have historically had difficulties engaging students in study

abroad opportunities. Having a curriculum that is structured to provide background on a topic, geographic region, and culture - before the study abroad opportunity is addressed - will hopefully encourage student engagement.

In the School of Engineering and Technology, approximately 7% of students are non-resident international students. Our curriculum provides our local students with an opportunity to enhance their experience at IUPUI by working together with the international student population – both groups of students will benefit from working together and learning from each other's differences.

Justification

"Business is increasingly conducted in a global environment, not only in terms of markets but also design, production and service. It is therefore essential that engineering graduates have an orientation towards this globalization and are prepared to operate effectively within it."[37]

This curriculum will enhance our students' education by providing them a unique opportunity to work on multidisciplinary teams and attack global issues. Presenting students with problems that affect the world around us will always create more compassionate graduates. In this case, there are also best practices that promote this type of curriculum.

The Engineering Technology degrees offered by the School of Engineering and Technology are accredited by ABET. As part of the accreditation, programs decide on outcomes for their students, and build a curriculum to meet these expectations. This series of courses addresses at least three of these outcomes directly:

- An understanding for professional and ethical responsibility
- The broad education necessary to understand the impact of engineering solutions in a global societal context.
- Knowledge of contemporary issues.

An understanding for professional and ethical responsibility: This curriculum is designed to provide engineering and technology students with a broad understanding of ways to apply their degrees. Not only will they set the application of their degree on a global scale, but they will also be introduced to ways their degree can affect social change.

The broad education necessary to understand the impact of engineering solutions in a global societal context: In this curriculum, students will have two different methods of understanding the impact of engineering solutions. They will be working in teams in the classroom made up of local and international students. Organizing teams in this structure demonstrates an educational best practice and provides the best learning experiences for both local and international students.

Peterson et al. (1999) state that programs that encourage cooperation among these two student populations "enable Americans to learn about cultures, histories, and global issues from

international students; to participate in environments where differences are acknowledged and respected, reducing stereotypical thinking; and to see beyond city and state borders to understand U.S. interdependence with the world."[32]

A knowledge of contemporary issues: Students in the engineering technology programs are expected to have discipline-specific knowledge, as well as a knowledge of contemporary issues. Imparting knowledge regarding these contemporary issues will only better prepare our students for success in their careers. In this curriculum, we have chosen to add an international dimension – a need which can be addressed with these skills.

The IUPUI campus also has a curriculum enhancement initiative called RISE. RISE stands for Research, International, Service, and Experiential learning. Our course proposal is unique in that it incorporates three of these options: International, Service, and Experiential learning.

- I: study abroad curricular experiences to enhance their learning and understanding of the world
- S: service learning courses to enhance their commitment to civic engagement
- E: credit-bearing experiential opportunities, such as internships, practical, clinical or fieldwork experiences

The students are given the opportunity to see what service looks like on a global scale, by first researching the content, working in groups in class to explore solutions, then finally, travelling abroad to implement those solutions. The curriculum approaches a topic that is not traditionally taught in today's engineering classroom. It has been shown, however, that "a lack of instruction and understanding of technological and environmental issues will seriously hamper the ability of future citizens to keep pace with the ever-expanding role of technology in all facets of their lives."[26]

Global Solutions for International Development

The goal of Global Solutions for International Development is to give students an overview of the issues facing developing communities worldwide and introduce them to ways they can make a difference. The course begins with a look at the historical context of development issues and the forces that lead to developmental disparities between the world's rich and poor nations, including international trade, international organizations, national and local governance, and the cultural imperatives that guide a society's actions.

Following a look at the societal context in which development takes place, students begin to think critically about the development process itself, and the role of the development worker within a community. They look at various approaches to development work and the steps necessary for successful project planning and implementation. Students are challenged to develop a community assessment survey that could be used to gather the information necessary to prepare a comprehensive development plan for a community. The importance of including the

community in the decision-making process is stressed continually throughout the semester, as is the concept of “appropriate technologies” to ensure that proposed solutions are within the means of the community to implement and maintain without forming a dependency on the development worker or organization and that through partnership with the development worker, communities become empowered to help themselves.

The second portion of the introductory course takes a marked turn toward specific fields of development. The first field students explore is water security, as water is among the most basic necessities of life and a foundation without which no other development project could be fully successful. Students are presented with global trends in water consumption and availability, as well issues of water pollution, water conflict, water policy, and privatization. Solutions for the provision of clean water are introduced on a variety of scales. Students learn about proper well siting, various methods of well installation, well-head protection techniques, and water pumping options. Alternative sources such as spring-fed water delivery systems, surface water and rainwater harvest options are presented, along with methods for water purification when water is collected from such potentially contaminated sources.

Building upon the lessons in water security, the course proceeds to issues of hygiene and sanitation. Students participate in an interactive hygiene training seminar developed by Indianapolis-based Fountains of Hope. Students complete each activity as it would be completed by community members actually receiving the hygiene training. The seminar is designed to use interactive drawing, story-telling, and role playing, as well as an extensive pictorial curriculum to teach such topics as hand washing, food handling, water storage, rehydration techniques, and the identification of symptoms related to common water-borne illnesses. Students also explore sanitation options ranging from simple pit latrines to full-scale sewer and wastewater treatment systems.

The next topic to be addressed is food security. Like water, proper nutrition is tantamount to successful development in all other spheres. Agriculture is introduced on a spectrum ranging from individual kitchen gardens to full-scale farming. Topics covered include soils, agricultural inputs, pest control, and animal husbandry. Students explore common nutrient deficiencies and their symptoms, and recommend what additions must be made to a deficient diet to correct or prevent such problems.

Issues of solid waste and pollution are addressed not just from the perspective of treating that waste generated within the community, but also the growing trend of waste making its way from the developed world to developing nations and the associated environmental, social, and health impacts. Waste-to-energy options then provide the perfect segue into additional energy alternatives in developing communities. Students explore everything from the use of human-powered machines to leapfrog technologies that allow far-removed rural communities to bypass the traditional electric grid.

Developing a solution to any one of these issues would require the placement of structures and infrastructure within the community. Once these topics have been addressed, students will explore the concept of permaculture—the relative placement of all features within the community to maximize the efficiency of the community system. Students will think critically about the necessary inputs to each feature, as well as the byproducts each feature might produce, to design a community where all physical needs are met and waste becomes a valuable resource.

The unit on economic development will introduce students to a variety of financial models appropriate for a range of social settings, such as microfinance, rotating savings and credit associations, village banking, and more. The effects of requiring social imperatives along with financial services will be addressed. Students will also explore the role of education in development from primary education through entrepreneurship and job training for adults with little formal education.

Finally, a variety of human rights issues are addressed, including public health, gender equality, population and family planning concerns, human trafficking, property rights, and the effects of conflict. The methods by which these and other human rights issues are addressed in a community have a great effect on its development potential. Many of these are deep-rooted cultural issues that are not easily changed. Thus, students will not only explore solutions to these difficult concerns, but also the different cultural perspectives that shape a community's stance and how to work cooperatively within a cultural viewpoint that may differ greatly from their own.

To reinforce the concepts presented in the classroom, students are given a semester project to which they contribute regularly throughout the term. At the beginning of the semester, students are presented with a community case study. Case studies are selected to be representative of a wide range of development scenarios, such as urban and rural communities, pastoralist and nomadic societies, and seaside fishing communities. At least one location is assigned from each continent, as well, to provide a variety of contextual scenarios, such as landscape, weather patterns, governance, and cultural background. Students must research the community or region to gain familiarity with historical and current conditions, then create a development plan for the community which incorporates each of the topics addressed in the classroom. At the end of the semester, students present their unique development plans and can observe how their peers chose to address similar problems within differing contexts.

The course meets once a week for three hours, which facilitates the use of multimedia, as well as providing a substantial platform for guest speakers to share occasionally throughout the semester. Most importantly, there is a heavy focus on group discussion and interactive activities. The course is not marketed solely to engineering and engineering technology students, but to students from many of the university's programs, particularly the School for Public and Environmental Affairs and the School of Philanthropy. It is through this interaction between

students of diverse academic backgrounds that new and broader perspectives are fostered and the curriculum surpasses the purely technical.

Global Solutions Design

Upon completion of the introductory course, students would have the option to continue their immersion in the Global Solutions program by participating in Global Solutions Design. This course further intensifies the practical application of the concepts taught in the introductory course by connecting students directly with a developing community to address a real felt need. Students will interact via email, video messaging, and community liaisons to learn about the cultural context, assets, and needs of the community. Students will work together with members of the community to determine its most urgent needs and develop a strategy to meet one or more of those needs. To empower the local community in taking ownership of the project, community members will be involved in the decision-making process throughout the semester. In this course, the balance between the social and technical will be fully realized as students practice designing a solution that is appropriate to the community partner.

Another unique aspect to the Global Solutions Design course would be a focus on group building and preparation for intercultural travel. Students would participate in a variety of activities to help them identify the unique strengths they each bring to the group, as well as their individual thinking styles and methods of problem solving, decision making, and leadership. The group would work together to incorporate the variety of individual personalities into a functional development team. Similarly, the cultural dimensions of the partner community would be explored in depth to foster a cooperative approach to the intercultural work.

Ideally, two community partnerships would be established in one country: one in a rural setting and one urban community. Students will develop solutions for both, while the academic sessions would include a focus on the unique strategies for rural versus urban development. For each partnership, a representative of the community or local development organization will be identified as the primary point of contact. This representative will serve to maintain the connection between the community and the classroom and will disseminate information between the two parties as needed. This representative must have a deep understanding of the culture and needs of the community and a sufficient grasp of the English language to communicate those concepts to the students. Course faculty will work closely with the community representatives to establish mutually convenient times for such communication to take place.

The type of solution developed for each community is not pre-determined, but decided together through communication between the community and the classroom. By continuing partnerships with the same communities year after year, a full-scale development program will be implemented to address needs in any of the development fields previously discussed.

Applied Global Solutions

In the third and final course of the Global Solutions series, students will have the opportunity to implement the project developed during the Global Solutions Design semester. Through IUPUI's Office of International Affairs, students will travel overseas and spend several weeks immersing themselves in the local culture while working side-by-side with community members to establish the solution devised together the semester before. Once in country, students would divide into two factions, one to visit the rural community and one to implement the urban project.

To ensure community ownership of the projects implemented during the trip, students will lead training sessions to educate community members on the proper implementation, use, and required maintenance of the projects. Community members will also be asked to work alongside the students in implementing the project to gain a deeper understanding of the structure or system that is being put in place and as a means of providing their own equity to the project. Where possible, community members may also be asked to supply a portion of the financial resources or materials necessary to complete the project.

During the trip, students will assimilate their new experiences through several academic activities. Students will be required to keep a journal documenting their experiences. Beyond a simple account of each day's activities, the journals will be used to encourage critical thinking as students provide analysis of their experiences and explore ways to apply what they learn to their own lives and communities at home. Guided group discussions will be used to help students share their feelings and ideas and provide insights to one another periodically throughout the stay. Key among the group discussions will be those that take place following the stay, when the two groups meet to compare their unique experiences and upon re-entry when students will evaluate the experience as a whole and its impact on their own perspectives and future decisions.

Both Global and Local

Many of the concepts presented throughout the Global Solutions curriculum are equally applicable to communities in the United States and many students may prefer to focus their attentions closer to home. To demonstrate these possibilities, the Global Solutions program will partner with the Riverside Watershed Environmental Living Lab for Sustainability (RWELLS). The RWELLS program is a partnership formed between IUPUI and the Riverside Civic League, the community organization representing the Riverside neighborhood. Riverside is located north of the IUPUI campus and has been subject to nearly three decades of urban decay, seeing the departure of businesses and residents, the deterioration of infrastructure, and a general decline in the quality of life. RWELLS was designed specifically to focus on improving quality of life and economic viability through water and energy initiatives.[34]

By partnering with RWELLS throughout the scope of the Global Solutions curriculum, students will have opportunities to apply the concepts learned in the classroom long before they get on a

plane to travel overseas. Students may work together with members of the Riverside community to establish water and sanitation solutions, energy initiatives, urban agriculture projects, and more. This practical experience will not only help students see the local applications of the Global Solutions curriculum, but will also help bring much-needed development opportunities to the Riverside community.

Curriculum Resources

The curriculum for each of the Global Solutions courses is not currently supported by a single textbook, but rather incorporates a broad range of resources including books, scholarly articles, documentaries, and guest speakers. The materials used to support the classroom curriculum are listed in the Resources section below.

Conclusion

In an important effort to keep our collegiate curriculum current and in touch with global needs, this course attempts to cast a wide net and attract students from all disciplines and backgrounds. Once the group works together, the strengths of each individual will shine and expose these students to new ideas and careers.

One population segment that is often underrepresented in engineering is women. The number one reason why women do not pursue education and careers in engineering is the "lack of connection between engineering and the problems of our society".[26] This curriculum directly addresses that concern, and is even co-taught by a female faculty member. In the second and third courses in this series, students have the opportunity to practice real-life scenarios and witness their impact first-hand.

This curriculum can be directly integrated into undergraduate coursework to fulfill elective requirements; furthering the potential impact of engineering education and careers. When introduced to these issues and ideas as a student, the potential for impact can be long standing and far reaching.

Resources

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