Preparing Engineers for Global Challenges: Engaging with Chile through the 100,000 Strong in the Americas Initiative

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Megan Echevarría has directed the Spanish International Engineering Program at the University of Rhode Island since 2008. She has extensive experience creating international study, research and internship opportunities for engineering students, as well as preparing those students for successful participation in such initiatives. As Associate Professor her teaching covers all levels and areas of the Spanish curriculum. She has developed specialized Spanish courses designed for engineers, as well as interdisciplinary courses that connect engineering to other fields of study. In her research she is equally versatile: her scholarship covers a wide range of topics relating to international education, languages across the curriculum, applied linguistics, materials development and literary and cultural studies.

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Dr. Sigrid Berka is the Executive Director of the International Engineering Program (IEP) at the University of Rhode Island, and also the Director of the German and the Chinese IEP, responsible for building academic programs with exchange partners abroad, internship placements for IEP’s dual degree students, corporate relations and fundraising for the IEP. Bi-annually, the IEP organizes the Colloquium on International Engineering Education. Under Sigrid’s leadership, the IEP received NAFSA’s Senator Paul Simon Spotlight Award for innovative campus internationalization (2011), and the Andrew Heiskell Award for an innovative study abroad program (2012) by the Institute for International Education. She was Co-PI of the winning grant proposal (PI Megan Echevarría) chosen as one of four to launch President Obama’s 100,000 Strong Initiative in the Americas (2014). Sigrid serves as Co-Editor, with Damon Rarick, of the Online Journal for Global Engineering Education (OJGEE) as well as on the Provost’s Global Education Steering Committee. She also serves on the DAAD Alumni Association Board. Since she began working at URI in 2009, the IEP has seen an enrollment increase of 18 % and added an Italian branch. Sigrid has raised close to $500,000 in corporate, foundation, government and private funds for the IEP. She held prior positions as Coordinator, then Managing Director of the MIT Germany Program (1996-2009) and as Assistant Professor of German Studies at Barnard College (1990-96). She has published a book and numerous articles on 19th and 20th German Literature, co-authored an intermediate German textbook, and has more recently published several articles in the area of International Engineering Education.

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In March 2011, President Obama launched the 100,000 Strong in the Americas Initiative from La Moneda in Santiago, Chile. Through this initiative the President aims to increase significantly student mobility between Latin America and the United States: 100,000 U.S. students studying in Latin America and 100,000 Latin American students studying in the United States. The overall purpose of the initiative is to promote increased intercultural understanding and prosperity throughout the Western Hemisphere so that people from across the region may work together more effectively to address global challenges that connect us in important ways, especially: “citizen security, economic opportunity, social inclusion and environmental sustainability.” In the words of President Obama: “Because when we study together, and we learn together, we work together, and we prosper together.”

With the President’s focus on promoting student mobility in order to focus specifically on addressing global challenges, it is not surprising that in the first round of grants for the 100K Strong in the Americas Innovation Fund one of the programs focused exclusively on students from STEM disciplines. Because the University of Rhode Island (URI) has worked for over twenty-five years to promote innovative internationalization in engineering education and our program’s goals align perfectly with the President’s aim for this program, we appreciate the prestigious recognition of having been selected as one of four United States institutions to inaugurate the 100K Strong in the Americas initiative. Our activities for this initiative grow out of our award-winning International Engineering Program (IEP), a five-year dual-degree program leading to a BA in a language and a BS in an engineering discipline. The fundamental goal of our program is to create opportunities for students to develop into bilingual, cross-culturally savvy engineers who possess a keen understanding of and are well equipped to address a variety of global challenges. In this paper we provide an overview of our project, describe the activities that we have designed and some of the hurdles that we have faced as we have begun implementing them, and discuss the ways through which we have successfully overcome various challenges.

Preparing engineers for global challenges

While only 3.9% of engineering students in the U.S. study abroad, and only 0.1% of those for an entire academic year, a full quarter of undergraduate engineering students at our institution are enrolled in our innovative program and through it spend at least one full year abroad, studying for a semester at one of our partner institutions and completing a six-month professional engineering internship with one of our corporate partners. While this long-term immersion experience for advanced students is a hallmark of our program, we also recognize the value and importance of organizing other types of immersion activities for our students in order to maximize their chances for growth during their time with us. Students who take full advantage of what we consider to be the “complete” IEP experience graduate from our institution not only with two degrees, but also with extensive experiential exposure to their engineering fields and to key global issues closely related to those fields. This comprehensive experience has an important impact on the high quality of our students’ technical preparation while also compelling them to engage in unique ways with people from other countries and to develop a deep sense of
intercultural understanding, social and economic awareness, and the potentially broad impact of their work as engineers.

The Spanish branch of the IEP has existed for close to two decades and, especially in recent years, has experienced important successes. Since 2008 we have carried out extensive recruitment activities, and as a result, we have seen tremendous growth: in 2008 fifty students were enrolled in the program and we now have well over twice that number. With such significant success in attracting a large group of students to our program, also come important opportunities for expansion. From the outset, the Spanish IEP has had a strong presence in Spain and Mexico, with four partner universities and a network of corporate partners who receive our students as interns. In an effort to diversify our offerings to students and also in response to the increasing complexity of accommodating all of our students in Spain and Mexico, we have recently explored collaborations in other areas. As a result, in South America our presence is now emerging: in 2013 we negotiated a bilateral agreement with the Pontificia Universidad Católica de Valparaíso (PUCV) in Chile and we have also developed contacts at companies and research institutes there who are eager to collaborate with us by receiving our students as interns.

Engaging with Chile

The primary goal of the activities that we have designed as part of the 100K Strong in the Americas initiative is to engage engineering students from the United States and Chile in immersion learning experiences, allowing our students to connect their study of Spanish more closely to their fields of engineering and to relate the technical content of their fields with some of the larger global issues surrounding that work. While some activities focus on learning through coursework in a classroom setting, most have a far more practical focus, taking place outside of the walls of the traditional classroom and creating opportunities for students to engage with different aspects of their fields of study in the real world. Some activities are designed for advanced students as a way to provide them with the chance to demonstrate the knowledge and competencies that they have acquired and develop them further, while also acquiring and refining other equally important skills. Other activities focus on the unique, and too often missed, opportunities to immerse younger students in meaningful field experiences. Finally, our activities also emphasize professional development and networking skills for students, by empowering them to participate directly in dissemination activities about our work. By designing short- as well as long-term immersion opportunities for students at different junctures of their studies from both countries, we seek to create synchronized stages of educating global engineers of the future, people who are technically skilled, and at the same time cross-culturally savvy, proficient in more than one language, and keenly aware of how their work can impact major social, political and economic challenges.

The first two activities that we have designed grow directly out of our program’s curricular model and focus on students who have already reached advanced levels in their Spanish language proficiency and also in their technical engineering knowledge and skills. The following two activities are designed for students in the early years of their studies as a way to create opportunities for them to engage with their fields of study in practical, real-world, global contexts. The final activity provides students from all of the previous activities the opportunity to reflect on and learn how to communicate effectively about their global experiences:
Activity 1: January-August Internship Program in Chile
Activity 2: August-December Bilateral Academic Exchange
Activity 3: August Sustainability Project and Study Tour in Chile
Activity 4: September-December Innovations in Sustainability Spanish course
Activity 5: August-December Campus Presentations, Conference Participation

The first activity is an internship program for Spanish IEP students in their fourth year of our five-year program. When this part of the program began, the students had already reached advanced proficiency in Spanish and had also developed strong theoretical knowledge and practical skills in their engineering disciplines. Participants in this portion of the project spent the fall 2013 semester in Spain studying at Spanish IEP partner universities. Once their final exam periods ended, they were to complete international engineering internships for academic credit awarded by our home institution. Because of the different calendars that our partners in Chile and Spain follow, the start dates of the internships have varied: one student was able to begin in February, while the other two began in early March.

In all cases, we carefully matched the students’ internship projects with their engineering major in order to maximize the integrated learning outcomes of their cultural, linguistic as well as technical hands-on experience. For example, one student in biomedical engineering has long-term plans to study medicine. As a result, his primary interest for his internship placement was clinical. One of his major responsibilities in his internship at a medical devices company is to work with the medical professionals who are using those devices in clinical settings. An electrical engineering student working at the same company has extremely strong programming skills and prefers hands-on projects, which led the company to choose him as the ideal candidate to assist them with a variety of tasks relating to information technology and quality management. Both students also have ample opportunity to develop equally important soft skills, like interpersonal, professional and intercultural communication, as they participate regularly in meetings and presentations with not only their Chilean colleagues and clients, but also with suppliers and manufacturers from around the world.

Each intern has a supervisor and mentor within the company, as well as an academic mentor from URI. The credit and grading structure for the internships is all handled through URI: the academic mentor remains in close contact with the company supervisor in order to monitor the company’s assessment of the student’s performance. At the same time, the entire group of Spanish IEP students currently interning are members of a group in the URI online course management system where they regularly post reports on specific topics relating to their internship experiences and where they read about and react to their classmates’ experiences and insights. By providing structured topics for the internship reports, we guide the students’ toward thoughtful reflection about their projects, their challenges, their interpersonal dealings in the professional setting and their overall cross-cultural growth. The guidelines help students begin to process and articulate the broader impact of the entire experience – technical, linguistic and intercultural – so that they may begin to make sense out of it in a larger, more meaningful context.

Our second activity consists of the direct exchange of engineering students from URI and our new partner university in Chile, PUCV. Fourth-year students from URI will go to Chile in
August in order to complete one semester of engineering coursework at PUCV and students from PUCV will travel to URI to complete a semester of coursework at our campus. While a semester of coursework in a foreign language in a foreign country has a potentially significant impact on students’ proficiency in the foreign language, the benefits of this activity go far beyond the ability to communicate effectively in a second language. The experience of immersing oneself for an extended period of time in a foreign culture, living in a foreign language and rising to the challenge of taking advanced engineering courses both in a foreign language and in a different academic culture creates priceless opportunities for our students to grow as people and as professionals, and develop a variety of skills that are essential to a globally competent engineer.\(^5\)

The third activity provides a short-term module in which younger students will work as part of an international team on a sustainability, service-learning research project in Chile. Faculty specializing in Environmental Engineering from URI and PUCV will collaboratively direct a two-week research institute in Chile to enable up to sixteen students (approximately eight from each university) to work together studying anaerobic energy systems and sharing their new knowledge with people in local rural communities in order to raise awareness about sustainability practices that could be easily implemented in those areas. Students will work together in order to analyze anaerobic digestion systems, subsequently design, create and test prototypes, and ultimately produce a model that will be useful to people in local rural areas. In order to reach this goal, they will work closely with Dr. Vinka Craver (URI), an environmental engineer and expert in sustainable technologies for developing communities, and Dr. Gonzalo Ruiz (PUCV) who has complementary expertise in Biochemical Engineering and directing a strong bio-energy program with several projects in anaerobic digestion for the generation of methane and algae-based biofuel. Prior to their departure, IEP students will complete one week of intensive preparatory work in Spanish in order to make certain that we maximize as much of their time on the ground in Chile as possible. During their time in Chile all of the students will blog in Spanish about their experiences and impressions and, upon return to the United States, the IEP students will participate in discussion sessions through which we will assist them as they process those experiences and impressions, and analyze the relevance of their project in a larger context of global challenges. Subsequently, we will hold public presentations on campus so that those students may share their insights and conclusions with our campus community.

This sustainability project serves as a way to engage students early in their academic careers not only with complex technical content relating to anaerobic energy systems in a practical, hands-on setting, but also gives them the invaluable opportunity to work as part of a multicultural team as they complete the project and to view and reflect on their work from a vantage point that makes the larger, highly relevant sustainability, social and economic issues quite salient. We project that providing a group of younger students from our program and PUCV students the chance to meet and work closely together during the summer early in their course of study will build their self-reliance and confidence in ways that will benefit them not only when they subsequently spend a longer period of time in another country, but as early as when they return to campus immediately after the short-term experience. While the IEP has always sustained the great importance of long-term immersion experiences and the priceless impact of such experiences on students and their efforts to become bilingual, cross-culturally savvy engineers, we also have anecdotal evidence suggesting that students who participate in short-term immersion activities prior to the full year abroad experience significantly greater growth during subsequent immersion activities.

August in order to complete one semester of engineering coursework at PUCV and students from PUCV will travel to URI to complete a semester of coursework at our campus. While a semester of coursework in a foreign language in a foreign country has a potentially significant impact on students’ proficiency in the foreign language, the benefits of this activity go far beyond the ability to communicate effectively in a second language. The experience of immersing oneself for an extended period of time in a foreign culture, living in a foreign language and rising to the challenge of taking advanced engineering courses both in a foreign language and in a different academic culture creates priceless opportunities for our students to grow as people and as professionals, and develop a variety of skills that are essential to a globally competent engineer.\(^5\)
We suspect that, regardless of whether or not the entire cohort of students participating in the sustainability service-learning project chooses to return to Chile for their full year abroad, all of those students will have a distinct advantage over their peers who have not participated in any short-term programs. The assessment surveys that we are developing as part of this activity will help us document, analyze and report differences in comfort levels between different cohorts when exposed to a foreign culture.

Our fourth activity is a specialized Spanish course for first and second-year engineering students at URI during the fall 2014 semester. The course is designed for Spanish IEP students in their first years of study as a way to bring global sustainability issues in the concrete context of Latin America to the forefront of their minds as early as possible in their course of study, while also creating a unique opportunity for them to link their study of Spanish more directly to their engineering disciplines. The course will provide students with the chance to use their Spanish skills to explore innovative sustainability initiatives of varying scope and led by a variety of groups (from large multinational corporations to local grassroots movements). Students will develop more advanced reading, listening, writing and speaking skills in Spanish while researching and analyzing these endeavors from multiple perspectives: technical, economic, political, cultural and social. Student and faculty participants from the previous three activities described above will also contribute to the course: students from the United States and Chile will participate in guest panels, Spanish-speaking URI engineering faculty will give guest lectures, and students enrolled in the course will interview students and faculty at PUCV via Skype.

The final component of our program consists of involving our student participants directly in the dissemination of our work, through presentations on the URI campus and also through the organization of panels and poster sessions at a conference on international engineering education in November. We will invite students from the activities described above to give public presentations on campus, serve as guest presenters in relevant courses, and to participate in poster sessions and panels focused on engaging with Latin America at the conference. For example, the interns will provide details about integration into the Chilean companies’ cultures, their own personal contributions to the companies’ projects, the global scope of their work, and the overall impact of their experience on themselves personally and professionally. The students from the sustainability research project will present on their own experience on the ground in Chile at two extremely different locations (the facilities of a top research university and a remote rural community) and how those experiences have modified and molded their understanding of and engagement with global challenges like environmental sustainability, social inclusion and economic opportunity.

Challenges and lessons learned

As we have begun to implement these activities, we have faced a variety of challenges, including: convincing students (and their parents) to consider Chile as a study abroad and internship destination, developing new company contacts and ideal internship opportunities in Chile and the lack of correlation between vacation seasons in South America and the United States and Europe.
Because of our long-standing relationships with our partners in Spain and Mexico and the fact that our partnership in Chile has begun only this academic year, most of our advanced students and their parents had only considered Spain and Mexico as potential destinations for the year abroad. As a result, our first challenge consisted of opening minds to the possibility of an immersion experience in Chile. For the interns this proved to be especially challenging. The students had been in Spain since August and just when they were feeling completely settled and acclimated, they had to make a decision about remaining in a place that had become quite familiar to them or uprooting themselves once again and beginning a new process of cultural adaptation in a new country. Three of the most adventurous spirits in this current cohort decided to rise to the challenge. In one case, the student enthusiastically embraced the opportunity, but her parents were opposed. It was only after further insistence and reassuring conversations that we were able help the student navigate the discussions with her parents and finalize her desired placement.

The process of securing ideal placements for students in most Spanish-speaking countries is complex, and Chile is no exception. Our first step was to research companies of all sizes throughout the country working in the areas of interest of our specific candidates. We then proceeded to reach out to those companies in order to begin to explore the possibility of collaborating. This process is extremely time-consuming and potentially quite stressful, thus requiring a great deal of patience, tenacity and grace under pressure.

As we explored opportunities with different Chilean companies, a minor issue that arose was the lack of correlation between the Chilean vacation calendar and the academic calendars in the United States and Spain. While in Europe most of our partners are eager to receive students at any point between early January and mid-February to begin their internships, in Chile that is a time when many employees are on vacation. As a result, many of the Chilean companies expressed strong preference for having the students begin their internships in March. In this round of placements, this turned out to be only a minor issue as there was a slight lag time between the moment during which the students finished their exams in Europe and their internship start date. The students in this current group ended up appreciating the time to travel, visit family or arrive to Chile early in order to enjoy the summer and begin to explore the new culture. In the future, this fact is something to consider carefully when planning internship placements.

A significant challenge that we faced was the Chilean companies’ compensation norms: most of the companies who were interested in partnering with us and offering our students outstanding learning opportunities were open to paying only very low stipends that did not come close to the subsistence stipend that we strive to obtain for our students. Since many of our students rely financially on our ability to place them in paid positions, we quickly devised a solution that has turned out to be extremely beneficial to both our partner company and the students. We proposed the option of providing, in lieu of the full subsistence stipend, a smaller stipend in conjunction with other benefits such as housing that would eliminate some of the students’ expenses. One of our partner companies discussed our proposal with their employees and an enthusiastic volunteer decided to host two interns in her own home with her family. As a result of this initial setback, the two students are now thoroughly enjoying the luxury, support and amazing learning opportunities that accompany a homestay in addition to their work at the
A variety of factors have made designing these activities especially feasible at our institution. The fact that we have an existing dual-degree program, curricular model, living and learning community and student base from which to expand is a tremendous advantage. Furthermore, we have the benefit of lessons learned from past experiences managing bilateral exchange agreements with universities in other countries, placing interns and creating short-term research opportunities and study tours in other countries. The unique situation of our language faculty, who possess expertise and interest in designing and teaching interdisciplinary courses related to engineering, is another undeniable advantage that not all institutions enjoy from the outset.

Another extremely important factor that has facilitated our work is our relationship with a highly compatible and complementary partner institution. On the most obvious level, our new partner in Chile makes it possible for our students to take advanced engineering courses designed for native-speakers of Spanish, and in some cases, to take courses on topics that would be impossible for them to study here at our own institution. It is also clear that our new partnership will also enrich our own classrooms and campus community through the presence of Chilean engineering students at our institution. What may seem less obvious is the role that our agreement has played in enabling our program to implement a key component of curricular model: the international internship. Without the sponsorship of our partner university, our students would not be able to obtain visas for the internship portion of their academic stay in Chile. Having previously investigated the visa requirements for United States students going to Chile in a variety of scenarios, when we worked together writing the agreement we were prepared to make certain to include mutually beneficial bilateral internship sponsorship in addition to the customary bilateral academic exchange.

The role of faculty in preparing students for global challenges

Finally, none of these activities would be possible without the individual commitment and preparedness of the various faculty members involved in the activities. The strong compatibility, complementarity and synergy between the two faculty members from both institutions who have chosen to work closely together co-directing the sustainability research project have been instrumental in making that component of our program with Chile possible. The fact that both faculty members have advanced proficiency in both Spanish and English and also extensive international engineering experiences serves as a testimony to the importance and added value of taking a commitment to global competence seriously at an institution. Many programs include global competence in their strategic plans and general education programs, and some even consider this important concept when developing new curricular offerings. Initiatives like those described in this paper require a stronger institutional commitment to global competence, one that focuses not only on concrete student experiences but that reaches those who come in closest contact with students and who are ultimately responsible for crafting student learning experiences. Faculty members who are proficient in more than one language, who have ties to other countries and who regularly collaborate with people from other cultures and countries are especially well prepared and motivated to initiate the kinds of activities described in this paper or, at the very least, to participate in such activities when colleagues or administrators create the
opportunities for them. Those faculty also tend to demonstrate uniquely global mindsets and skills, among them: being able to communicate at a professional level in a second language,\textsuperscript{6} showing appreciation of other cultures and understanding of cultural differences,\textsuperscript{7} knowing how to work with and provide leadership for ethnically and culturally diverse teams,\textsuperscript{8} possessing knowledge about the history, political and economic systems and situations of other countries,\textsuperscript{9} knowing how to interact effectively in both social and professional contexts in other countries,\textsuperscript{10} and understanding from firsthand experience what it means to work “effectively with people who define problems differently.”\textsuperscript{11} In short, these globally competent faculty are the perfect role models for students who themselves are striving to transform themselves into globally competent engineers.

\textbf{Bibliography}
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7. Ibid
8. Ibid