

The University of Rhode Island International Engineering Program: A Model for Globalizing the STEM Disciplines¹

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Languages and Engineering: Partnering for the Future

We, the authors of these pages, are both the current director and the recently retired founder, director, and developer of a now twenty-seven year old program at the University of Rhode Island which has proven it possible for students to simultaneously achieve the goals of both a technical **and** a global/liberal arts education in a manner which is highly appropriate to today's workplace. The International Engineering Program (IEP), which was developed in close partnership with business and industry, is a cost-effective, career-oriented program combining the study of language and culture with engineering, and including a full-year of study and work abroad. It is a five-year undergraduate curriculum, leading simultaneously to both the BA in a language and the BS in one of the engineering disciplines. IEP grads are highly qualified engineers, who have stronger writing, speaking, analytical, and problem-solving skills, in combination with the command of a second language and the cross-cultural communication skills acquired through a year of in-depth study and work abroad. With over 400 graduates, the program continues to boast an extremely competitive employment rate and demonstrate the fact that the humanities and the sciences can work together productively, i.e., that universities can indeed adapt to the contemporary needs of society. Our research documents the long-term value of such an education in today's workplace, where IEP graduates have been able to excel and achieve beyond their initial expectations, and make meaningful contributions to society.²

The IEP is built, of course, on the reality that engineering is a global field today and that engineers commonly work in teams crossing many cultural and linguistic borders. Even when not travelling, it is typical for engineers to be working on projects with others in widely dispersed locations, and such work requires knowledge of and sensitivity to other cultures and languages for communication to succeed. Engineers need to be many things today: technically savvy, analytically sharp, culturally astute, good problem solvers, able to take calculated risks, good communicators, cross-culturally informed, and lifelong learners. The IEP experience is designed to support the acquisition of all of these skills with its curriculum that combines the best of both a technical and global humanistic education.

¹ An earlier version of this paper appears as part of a larger project in the ADFL Bulletin, 43.1/April 2014.

² See: Grandin, John, Going the Extra Mile: University of Rhode Island Engineers in the Global Workplace, Rockland Press Rhode Island, 2011.

At the same time, the IEP model which has successfully linked the languages with engineering at the University of Rhode Island, and has additionally served as a model for a languages for the professions track within URI (for business, Computer Science, pharmacy, and textiles) as well as externally³ for various successful international engineering or science programs such as at Valparaiso University, University of Connecticut, University of Cincinnati, Iowa State, Purdue, and more recently at Northern Arizona University, can claim that it gave language enrollment at URI a significant boost, and in the case of some, literally saved the languages at URI. The case of German at URI with a total of 182 majors shows that this development owes its enormous success to the IEP: currently 88.7% of German majors are double majoring in engineering and German, 10% in Business & German, and the rest is combining German with yet another discipline or are “pure” German majors. It is easy to see that German would not have survived at URI without the “marriage” with engineering. Instead the German program, which does not even feature a master’s or Ph.D. degree, became one of the largest in the country, the 2nd largest in terms of major enrollment after the University of Michigan⁴; and tying in 6th place with the University of Madison Wisconsin with respect to graduating German majors.⁵ (The University of Rhode Island, of course, has less than 1/3 of the typical undergraduate enrollment of Big Ten schools and is not offering a graduate level German program.)

The following pages will be devoted to a detailed explanation and analysis of the University of Rhode Island’s International Engineering Program. Our discussion intends to show not only the need and value of scientific/technical education in combination with the study of language and culture, but also a workable path for the reorganization of the current higher education structure which is so heavily burdened and constrained by historic traditions and interest groups. To merge disciplines such as language and engineering is not simple, and, even though successful at URI, might seem to many to be basically undoable on a larger scale. Yet, the IEP experience at URI has proven such cooperation possible and to the benefit of all parties.

Partnering Across the Disciplines

The University of Rhode Island International Engineering Program (IEP) began as a partnership between two faculty, Dean Hermann Viets of the College of Engineering, and Professor of German John Grandin, who also served as associate dean of the College of Arts and Sciences. Both shared a common interest in Germany and the belief that all students, and most definitely engineers, would greatly benefit from becoming bilingual and by including a significant experience

³ A special volume on “Bridging the Languages with Engineering: In Honor of John Grandin” in *Online Journal for Global Engineering Education*: Vol. 6: Iss. 1, available at: <http://digitalcommons.uri.edu/ojgee/vol6/iss1/> bears witness to the inspirational role the IEP has had for other institutions in the field.

⁴ According to statistics in *Monatshefte*, Vol. 104, Number 4, Winter 2012

⁵ According to statistics in *Monatshefte*, Vol. 102, Number 4, Winter 2010

abroad as part of their undergraduate education. Recognizing that both of their respective areas would win from such collaboration, and respecting and trusting each other, they soon recruited other language and engineering faculty for their discussion who jointly developed the concept leading to the IEP model. Students, they decided, could study language and engineering for five years, complete a six-month professional internship abroad during the fourth year, and earn both the BA in German and the BS in any one of the engineering disciplines. They would then enter the workplace with a significant advantage, especially given the increasing internationalization of the technical fields.

Grandin and Viets were well aware that they were entering a partnership fraught with barriers and hurdles. Aside from some outspoken engineers who saw no need for language study and a core group of language faculty who saw no reason to teach languages to engineers, there were manifold challenges from many bureaucratic corners of the academy. Would it be feasible or even wise to complete two undergraduate degrees in five years? Could we really arrange six-month professional internships in companies abroad? Who would teach the proposed special, content-based German classes for engineers? How would we recruit students to study both German and engineering? Would students see value in spending an additional year before entering the workforce? Who would find answers to these questions and complete these tasks? Despite the many questions, Viets and Grandin believed this all the challenges could be met and they agreed to pool their efforts and sell their idea, each to their respective faculty groups, arguing strongly that such a partnership would be mutually beneficial.

Indeed the partnership between Grandin and Viets, which grew to a partnership between engineering and languages, or viewed more broadly, a partnership between technology, science and the humanities, and subsequently a partnership between the university and the corporate sector, has been a great success and truly beneficial to all parties. The IEP today enrolls 365 students, boasts over 400 graduates, and has expanded from the initial German and engineering model to include programs with French, Spanish, Mandarin Chinese, and most recently Italian. It has benefitted languages, for example, by vastly increasing the number of German majors at the University of Rhode Island from a shrinking handful to over 180. Benefits for the engineers included not only an increase in applicants to all engineering fields at URI, but also a substantial increase in the quality of the students. By marketing the IEP as a challenging program for gifted students who wanted more than what the pure engineering major could provide, the IEP became a magnet for such students. Gifted and motivated students committed to engineering, but seeking something to enhance and build on their technical skills, are attracted to URI and the IEP, often turning down admission offers from far more prestigious schools.

The IEP as Community

The IEP is by definition an academically challenging program. The engineering curriculum by itself has a reputation for rigor, whether at URI or elsewhere, with demanding admission standards and a high rate of attrition. To add a language

major, additional humanities courses, and a full year abroad to that workload is an intimidating thought, meaning that the IEP is not for everyone; it is designed for those with considerable academic talent, the ability to grasp its benefits, the motivation to want to achieve its goals, and a willingness to work hard. For this reason, IEP students share a common identity from the beginning; they seek each other out and learn rapidly to rely on each other, to support each other and to work closely together. In addition, they are grouped into IEP language specific freshman learning communities from the beginning, when they are assigned to their mandatory introductory EGR 105 section. As a result, the program carries with it a certain *esprit de corps* and sense of community, enabling students in the program, as well as faculty, to recognize each other as members of a special group within a large and far less personal state institution.

Building on the idea of IEP as community, the faculty leadership expended a great deal of effort to create a stronger physical presence for the program on campus, resulting ultimately in the establishment of a two-building complex at the main entrance to the URI campus now serving as the residential and administrative headquarters for the program. The IEP House and the Texas Instruments House provide program offices and meeting space as well as residential and dining facilities for 80 IEP students. Named for the chair of the IEP Advisory Board, the Heidi Kirk Duffy Center for International Engineering Education is a multifaceted meeting point for all IEP students and associated faculty. Students and faculty can gather there, take their meals there, and up to 80 students, including several exchange students from partner universities in Germany, France, Spain, Italy, Mexico, and China reside in the two buildings. URI students receive free tutoring from the native speakers in exchange for housing discounts for those students. Exchange students are paired with URI undergrads who are learning the language of their home country and are living with them on language specific floors (such as the German Max Kade floor, the Spanish floor, the Chinese and soon-to-be Italian wing). This miniature partnership between U.S. and foreign student provides a relaxed and less stressful atmosphere to test a student's budding linguistic skills before heading out to the target country. Research on language learning in university language houses has shown that the gains in living in such housing can surpass those acquired in short-term study abroad stays and clearly outpace the progress of students learning only in the classroom.⁶

The IEP House and TI House were made possible by a partnership between the IEP faculty, the university, and private citizen and corporate donors. The idea arose as the result of the deterioration of the university fraternity system, which left the URI campus with these two vacant fraternity houses, both in very poor condition and badly in need of extensive renovation. The IEP decided that the buildings could be saved and made a bid to do so, with the intent of operating them independently, if not as profit centers, at least as a complex which could take in enough income from student residents to enable them to be self supporting. Though the two buildings are now University of Rhode Island property, they were

⁶ Rob A. Martinsen, Wendy Baker, Jennifer Bown, Cary Johnson, "The Benefits of Living in Foreign Language Housing: The Effect of Language Use and Second-Language Type on Oral Proficiency Gains," The Modern Language Journal, 95, ii, (2011)

owned at that time by the fraternities. This made it possible for the IEP to negotiate directly with those organizations and with private contractors to make the necessary renovations. Complex state bidding processes were largely obviated, enabling the program to move forward on the project more rapidly than the university might have been able to do on its own.

The two-building Center was made possible by a self-financing structure based upon income from student residents and special summer programs which has proven itself viable and effective and is still in place today. It would not have been possible, however, without the substantial support of private and corporate donors who strongly endorse the IEP, its goals and its success. Over \$1.5 million dollars was raised from companies and individuals, including Heidi Kirk Duffy, the Texas Instruments Corporation, Sensata Technologies, ZF Friedrichshafen AG, the TRW Corporation, and the Max Kade Foundation. The University of Rhode Island also took over individual parts of the project and has more recently assumed a large part of the debt for the final purchase of the IEP House.

It is important to note that the IEP living and learning community is a wholly entrepreneurial outgrowth of the program and that it is self-managed with very little infrastructural support from the university. The full-time IEP Assistant Director of the IEP Living & Learning Community is paid from the income collected from students and special programs, as is the full-time kitchen staff, who serve meals three times a day for residents and other IEP students purchasing meals on a per meal basis. The cleaning staff is likewise on the IEP payroll, just as several ongoing maintenance items. Jokingly, we have often argued that the IEP is in the hotel and restaurant business, while in all seriousness we point proudly to the fact that these services are offered to IEP students at less than the costs of similar services in the URI dormitories.

A New Kind of Teaching

Establishing the International Engineering Program meant a major shift in professional duties for founder John Grandin. Prior to that time, he had been a traditional professor of German, teaching three courses of German language and literature per semester and pursuing a research and publication program in German literature. But after launching the IEP together with Hermann Viets, his career took a very different direction. He first became a grant writer and fund-raiser, then a program developer, student recruiter and advisor, and teacher of specialized German language courses for students of engineering. The next steps involved the creation of an advisory board from the public and private sectors, and outreach to companies, both in the U.S. and Germany, to foster interest in the program and its students and to create six-month internship opportunities in Germany. Soon there was the addition of a program in French, to be followed by Spanish and Chinese. Then came the housing program, the dining program, and renovation of the buildings, with all of the issues associated with their management and maintenance. As the program grew, the duties and responsibilities grew even more. Soon there would be the addition of an assistant director, the development of short-term study tours for younger students, the creation of a regular newsletter,

outreach to alumni, complex recruiting programs, and meetings with alumni, not to mention the founding of a yearly professional conference, the Annual Colloquium on International Engineering Education. To this was added the founding of a professional journal dealing exclusively with the issues faced by the IEP and their like-minded colleagues around the country: The Online Journal for Global Engineering Education.

It is safe to say that an IEP director, though he or she may bear the title of professor of German, is anything but a typical university professor. The job migrated for Grandin from nine hours a week in the classroom to a 24/7 position of management and coordination, all of which he has always considered, nevertheless, to be variations on teaching. He came to see himself as a manager, entrepreneur, and innovator, whose activities are committed 100% to developing academic and career opportunities for students, and helping the university to align itself with society's needs.

Though Grandin did less and less traditional classroom teaching as the program matured, he, and now his successor, Sigrid Berka, came to see themselves as a new kind of teacher with increasing hours of contact with their students. An open-door office brings in a steady stream of students. Preparing students for study abroad and professional internships is technically not a classroom experience, yet an important part of the educational goals of the IEP, requiring many meetings, face-to-face and in groups. Helping students design their foreign language resumé or draft their letters of application for internships is an equally important educational step. Sitting down with students at the lunch table to learn how they are doing and what problems they may be having is likewise an important part of this new form of teaching which features an expansive advising component.

This new phase of his professional career did not mean that Grandin would turn his back on the research and publication side of his professorial obligations. It did mean, however, that he would give up his earlier role as a researcher on the works of Franz Kafka, to become a writer, presenter, and disseminator based on his experiences as an international educator and academic entrepreneur. Indeed, Grandin's resumé grew steadily during the IEP years, as he became more and more of an authority on the internationalization of engineering education, the placement of students in international internships, fund-raising and grant writing, and the teaching of content based language courses, all of which are reflected in his lengthy list of publications.

The unique shape of Grandin's career and the many sides of the program worked well for several years, but gradually entered a crisis phase as it became time to think about retirement. How, we asked, would one find someone else to pick up all these pieces and continue the program? There is no graduate program training future professors to be IEP directors! There is no systematic provision for tenure and promotion of such a faculty member. Would there be another German professor who could oversee such a program, advise students, raise funds, coordinate outreach to global companies, manage a staff, and continue to build the bridge between engineering and the humanities? Would there be an engineering faculty member who could take this over?

Fortunately the questions were answered positively as the program searched nationally and internationally and found Dr. Sigrid Berka, coauthor of this paper. She too began her career as a faculty member in German at Barnard College, with a Ph.D. in German literature. After teaching for several years, she had found her way to an administrative position at MIT, where she was likewise managing the placement of engineering students for internships with companies and research laboratories in Germany, and served as industry liaison and fundraiser for the MIT-Germany Program which is part of the MIT International Science & Technology Initiatives (MISTI). As a natural teacher, an excellent writer, a well-organized administrator and creative and innovative thinker, she has been able to jump in where Grandin left off upon his retirement in June 2010, and the program continues to thrive. She too knows this position to consist of a new kind of teaching and advising, which can be far more demanding than the traditional role of a professor of German, but, at the same time, far more exciting. What this means for the University of Rhode Island in specific and higher education in general will be discussed below.

A New Kind of Learning

The IEP curriculum is far more comprehensive than that of the traditional major, whether in engineering or languages. Though it has its share of typical classroom learning, the overall program is part of a well-planned all-encompassing living, learning, and working experience focusing on the development of technical understanding and skills, as well as in-depth language and culture study and learning. What happens in the classroom is supported outside the classroom through a regular interaction with peers and faculty, through study tours abroad, through professional internships at home, through study and work abroad, and through capstone learning experiences in the final year. In short, the IEP provides a supportive framework enabling motivated and gifted young people to prepare broadly and extensively for lives and careers in today's complex global society. The IEP curriculum thus reflects the goals a strong language program should have according to the American Council on the Teaching of Foreign Languages (ACTFL): to develop students' language proficiency around modes of communicative competence reflecting real life communication. Unlike the classroom of yesteryear that required students to know a great deal of information about the language but did not have an expectation of language use, today's classroom is about teaching languages so that students use them to communicate with native speakers of the language. This is what prepares them to use their language learning as a 21st Century Skill.⁷

ACTFL's national standards are undergirded by five goals, the five "C"s, and each one of them is met by the goals and the practice of the IEP curriculum: IEP students "Communicate" in languages other than English; they gain knowledge and understanding of other "Cultures"; they "Connect" with other

⁷ The 21st Skills Map. Designed in Cooperation with the Nation's World Language Educators, spear-headed by ACTFL and the Partnership for 21st Century Skills (P21), accessed on Nov. 24, 2012 at http://www.p21.org/storage/documents/Skills%20Map/p21_worldlanguagesmap.pdf

disciplines and acquire information; they develop insight into the nature of language and culture by “Comparing” the foreign with their own; and they participate in multilingual “Communities” at home and around the world.

Both the language and the technical learning experiences are integrated into each semester of the five-year program. The language learning is further highlighted by the design of content-based language courses, allowing the students to enhance their language skills in courses infused with technical materials.⁸ IEP language learning also focuses on cultural issues and cross-cultural communication, helping to prepare students for their year abroad as exchange students and professional interns. In the final year, after students have strengthened their language abilities with a year of in-country use, students are prepared to deal with sophisticated texts selected from the history of the culture and literature of their chosen language. By graduation they have advanced-level proficiency in the language, backed by direct experience with engineering as it is taught at a technical university and as it is practiced in the country of their choice. Students in study abroad situations tend to interact and speak more and use language as a tool more than an end goal if they are engaged in a pragmatic, natural environment where problem solving in a team is required; where they can go beyond simplistic and superficial language use; where their interaction fulfills a real-world purpose (e.g. solving a technical or medical problem with others) in a context they are passionate about.⁹ We can only verify this claim from experience showing that the linguistic gains are highest for our students after the six month internship, which is also the time when they separate from their peer cohort at the partner university, and are sent in all directions to their internship hosts. They come back with at times amazing command of advanced technical concepts.

The IEP is a demanding program in terms of its language and time-spent-abroad requirements. Students in the program may participate in optional, short-term study tours abroad without considerable background in the language. However, no student is sent abroad for study and professional internships without having completed at least six full semesters of language study or the equivalent, and at least six semesters of the engineering curriculum. With this stringent requirement, the IEP sets itself apart from most study abroad programs, whether in engineering or any field. The trend today in American higher education is to send more students abroad, but predominantly for short-term stays such as in the summer or between semesters, and for programs conducted solely in English.¹⁰ IEP students complete a full semester at a partner university, where they study engineering and language/culture, and complete research projects in university

⁸ See: "German for Science and Technology: Teaching Strategies for Beginning Students." *Die Unterrichtspraxis / Teaching German* 34.2 (Fall 2001): 119-132 and Rarick, Damon O., "The Student Centered Classroom Made Real: Transforming Student Presentations in an Advanced Course on Technical German," *Die Unterrichtspraxis/Teaching German* 43.1 (2010), pp. 61-69.

⁹ These observations have also been attested to by researchers at Brigham Young University when observing language learners in service learning projects abroad. See: Martinsen, Baker, Dewey, Bown, and Johnson, "Exploring Diverse Settings for Language Acquisition and Use: Comparing Study Abroad, Service Learning Abroad, and Foreign Language Housing," in *Applied Language Learning* 2010, Vol. 20, Nos. 1 & 2, pp. 45-69.

¹⁰ See: Institute for International Education, Open Doors 2012 Report

institutes, with all work done in the language. The work is pre-approved, enabling students to complete a full semester of credit, which is transferred to URI.

The internship follows the semester of study and is carried out in collaboration with cooperating companies in the country of the target language and culture. Internships are professional, full-time, paid, and conducted under the supervision of an engineering mentor. The internships are also arranged to coordinate with students' majors, i.e., mechanical engineers often work with automotive-related companies, electrical engineers with companies such as Siemens, chemical engineers with companies such as BASF, and so forth. While on location during the six-month period, the students are required to submit bi-weekly written reports in the foreign language, discussing their work and offering observations on the culture, both in a day-to-day sense, but also as it impacts engineering practice in that location.

By working carefully with our partner companies, the IEP strives to coordinate the overall IEP learning experience with the growth of the students' professional skills on a step-by-step basis. IEP students have the opportunity to work first as summer interns in the U.S. with many of our partner companies, thereby gaining the first exposure to professional practice in a global company close to home. Ideally this first internship becomes the first practice-oriented building block for a comprehensive plan, leading to related research at a partner university abroad and a related project for the professional internship in that country. Finally, this same topic or subject matter can form the basis for the student's final year capstone research project at URI, again conducted in concert with the same partner company.

The IEP year abroad is financially very cost effective, especially when compared with most study abroad programs arranged by American universities. The IEP semester of study is based upon a one-to-one exchange relationship with the IEP partner schools. Participants in the exchange meet all financial obligations at the home institution and then exchange places, one-for-one. By special arrangement, IEP students pay in-state tuition for the one semester of study, whether they are in-state students or not, and they are not required to pay any tuition during the internship semester. Living expenses are highly subsidized at German universities and thus far less expensive than in Rhode Island.

Expanded Learning Outcomes

In a recently published study of fifteen IEP graduates in the workplace,¹¹ John Grandin sought to define more clearly what skills or qualities IEP students specifically gain from the international components of this unique five-year program, and how these come into play in their professional careers. What skills are gained from the IEP curriculum and from the time spent abroad? What skills or qualities are acquired over and above those of a traditional engineering program? And what difference have the outcomes of the IEP education made for them in their lives and careers since graduation? Grandin interviewed the fifteen

¹¹ Grandin, John, Going the Extra Mile: University of Rhode Island Engineers in the Global Workplace, Rockland Press Rhode Island, 2011.

students in depth, asking them to look back at their undergraduate years and to evaluate what they achieved as a result of the IEP, and how it may have helped them in their professional lives.

Historically the IEP has always promoted itself as a special program with a strong international dimension. It promises a first rate engineering education, and language skills strong enough to participate in an accredited semester-long study abroad program at a partner university, as well as a six-month professional internship. The IEP has always argued that study and work abroad in the language give access to a culture and professional practice in a manner otherwise not available. Students develop strong language skills, strong cross-cultural communication skills, appreciation for different points of view and different attitudes influencing things like design, safety, environmental protection, and quality. IEP students also become mobile, flexible, and tolerant of difference.

Grandin was able to legitimize these claims through the case studies of these fifteen alumni, but he was also able to discover other commonalities among this group that the program had not typically identified. Each member of this group stressed, for example, that he or she had developed far more advanced problem solving skills during the time spent abroad. They pointed out that they were sent to another culture well outside of their comfort zone, where all matters, both large and small, were dealt with in another language, and where they were expected to take far greater responsibility for themselves. Adapting to a different university system, a different dormitory philosophy, a different banking system, different diet, different sense of humor, different interpersonal reaction patterns, and so forth, required attentiveness and a sharp learning curve, all to be dealt with in a milieu which provides far less hand-holding and spoon-feeding than the American university system. Learning to use their language skills and to build on the background that had been provided through three years of study was a huge challenge in and of itself. But beyond that, they all reported that each day brought new issues, new problems, new challenges, linguistic, cultural and otherwise, but that this process in turn resulted in major personal growth during the year abroad, enabling them to return home and enter their careers with a far greater maturity than most of their peers who did not have such an experience during their undergraduate years.

The members of this group also reported that their success in learning to communicate in another language and in another culture, along with their new problem solving skills led to a greater sense of self-confidence, and a new sense of what they might be able to achieve in life. Learning at age 21 that one can live abroad, that one can communicate in another language, that one can, for example, successfully take a seminar in Finite Element Analysis in German and apply that knowledge in the workplace, builds confidence and helps one to understand that goals once thought to be mere dreams are now achievable.

While studying and working abroad for one year provided a boost in self-confidence and helped to raise the personal bar for members of this group, the fifteen alumni also reported that the experience enhanced their ability to take calculated risks. In looking back, the alums could view the IEP curriculum itself as a risk which paid off handsomely. They committed to learning a new language,

spending a year abroad, taking engineering courses in a foreign language, going to work for a company with unknown supervisors, no prior experience, unclear assignments in advance, and yet they met all these challenges and succeeded. As a result, they were each able to reassess the future and the goals they might set for themselves. Matthew Zimmerman, for example, had the courage to turn down job offers in his senior year, with the belief that he could start his own company – which he did. Sharon Ruggieri turned down an offer from a major automobile manufacturer with the hope that she would be accepted to MIT’s Sloan School of Management – which she was. Rather than go directly into a full-time job in the U.S. after graduation, Daniel Fischer chose to do a second internship with Siemens in Germany, with the hope that he might be able to land a regular position with them at their German headquarters for MRI technology – which he did. Sareh Rajee decided to apply for early admission to Brown Medical School – where she recently completed her MD while also earning the Masters in Public Health from Harvard, and was then accepted to Yale’s Vascular Surgery Program.

Partnering with the Private Sector

If the IEP relies on a willing interdisciplinary partnership within the institution, its relationship with the private sector is equally important and equally vibrant. Since its beginning, the IEP has relied on globally involved companies who see the value of the program and participate by providing paid internships to qualifying students. Initial contacts with companies in Germany were made by Hermann Viets and John Grandin, with the promise that we would send students with a good conversational ability in the language and at least third-year standing in the engineering curriculum. The companies, in turn, agreed to provide a meaningful, supervised, professional internship experience with a housing arrangement and a subsistence stipend. From the beginning it was clear that the companies valued the idea of American engineers with global communication skills and most hoped, in the long run, to be able to hire IEP graduates.

Viets and Grandin found business and industry very open to the idea of a partnership with the IEP and more than willing, if not eager, to play a role in shaping such an educational curriculum. Our corporate partners thus helped us found an external advisory board for the program, whose members would help guide its direction and eventually also support it financially. The IEP Advisory Board is made up of members of both the public and private sectors, including the German Consul General in Boston and corporate leaders from several global companies, some of which are U.S. companies with subsidiaries abroad while others are European companies with strong representation in the U.S. The Board is chaired by a private citizen, Heidi Kirk Duffy, who has a strong commitment to the IEP and has been one of its strongest financial supporters. It meets as a group annually, most often at the URI campus, but every third year or so at a location abroad, at one of our partner universities or at the headquarters of one of our global partner companies. To date the group has met in San Sebastian, Spain, in Paris, and in Munich, Berlin, Friedrichshafen, and Braunschweig, Germany.

Our corporate partners all provide internships for our students, with approximately 50 placements per year in Germany, France, Spain, Mexico, and China. Given the fact that participating companies are global in their structure and commitments, it is often possible to work with the same companies in multiple countries. Our German partner, ZF Friedrichshafen AG, for example, has provided internships for IEP students in Germany, France, Spain, Mexico, Brazil, China, and the U.S. Ideally students are placed with a partnering company for a summer position following the second and/or third years of the curriculum, and then placed with the same company when completing the six-month position abroad, e.g. with Hasbro Corporation in Pawtucket, RI, then Hasbro in Shenzhen, China; with Sensata Technologies in Attleboro, MA, then with Sensata in Changzhou, or with Toray Plastics in Quonset, RI, then with Toray in France. This provides a consistent educational plan for the student, while giving the company the opportunity to review the student's work and capabilities in two different locations. The student also, in such situations, collaborates with the same company when completing the required senior design project.

Most of the IEP cooperating companies have become willing partners, partly out of their personal eagerness to be involved in education innovation at the university level, but also due to the direct benefit they can accrue by hiring IEP graduates. Our partner companies are very aware of the need for engineers with international experience and global communication skills, and are thus eager to be in the front line when the best students are ready to enter the workplace. Now that the program can boast an alumni body of over 400, the partner companies can assess the extent to which their participation has been worthwhile. Although many of the grads have gone to work for other firms, a sizeable number has indeed joined the cooperating companies. Thus, there are IEP graduates working for Siemens in Germany and the U.S; for BMW and Mercedes, likewise in Germany and the U.S; for ZF Friedrichshafen AG in Germany, the U.S., and Japan; for Continental AG in Germany; for MTU Aero Engines in Germany and the U.S.; for Sensata Technologies in the U. S.; for Hexagon Metrology in the U.S.; for the Deutsche Bahn in Germany, for Total in Paris and so forth.

Partner companies see it in their direct interest to work with the IEP and also to support the IEP financially over and above the promise of internship positions and stipends. As noted above, several of our companies supported the development of the IEP House and the Texas Instruments House. In addition, many of our partners have provided scholarship support for our students, in the form of direct grants or endowed scholarship funds. More recently, our partners, along with many alumni and other friends of the IEP, have contributed to an endowed directorship fund, which is being established in the name of emeritus director John Grandin.

Other Partners from the Private Sector

The IEP has also benefitted from the support of both private citizens and private foundations who have responded enthusiastically to the goals of the IEP and the concept of preparing American engineers to compete successfully in today's global

workplace. IEP Advisory Board Chair Heidi Kirk Duffy has been a faithful and committed supporter of the program since its founding and has served as its board chair for over twenty years. A German by birth, she was able to help the IEP make some of its original connections with companies in Germany, such as the automotive giant ZF Friedrichshafen AG. Out of gratitude for her ongoing support and years of help, the two-building IEP living and learning community has been named for her as the Heidi Kirk Duffy Center for International Engineering Education.

The IEP has also been supported by private foundations which have identified with the goals of the program. The Max Kade Foundation, for example, was happy to support a program which creates a new and powerful rationale for the teaching of German language and culture in the U.S. Kade supports several IEP program functions annually and was a major donor for the creation of a German language floor in the Texas Instruments House. In addition, the Max Kade Foundation supports students enrolled in the dual masters program between URI and the Technische University Braunschweig, has, since 2013, supported a Distinguished Max Kade Lecturer to teach at URI for one semester annually, and for the first time, will also support 25 students going on a J-term study tour to Germany in January 2014¹². The Van Meeteren Foundation in Germany has been eager to provide financial assistance to the IEP as a new and innovative model for the exchange of engineering students between the United States and Germany. Van Meeteren provides funding to support the travel and living costs for students going for their year in Germany. Another avenue of private support is the endowment formed in the name of a former faculty member at URI who wished to help Rhode Island students learn languages other than English. The Demers Scholarships have gone to URI students who could demonstrate in their proposal a long-term commitment to language studies. In 2013, eleven out of thirteen scholarships went to IEP students, one to an International Business Program student, and one to a Chinese Flagship student. All of them could demonstrate in their proposal that they applied for a meaningful immersion program abroad, one likely to raise their skill level substantially.

Partnerships with Government

The IEP has relied heavily on financial support in the form of governmental grants from the United States, the Federal Republic of Germany, and the Peoples Republic of China. The very first extramural support for the program came from the Fund for the Improvement of Post Secondary Education (FIPSE) in the U.S. Department of Education. FIPSE leadership at that time was enthusiastic about sending engineering students abroad and rethinking how and for what reasons languages are taught in American colleges and universities. As a result, the IEP worked closely with FIPSE for eleven consecutive years, each of which included

¹² For a discussion how a short-term study tour can retain engineering students in the IEP, see Berka, Sigrid (2011) "Retaining Engineering Students through a January Term German Immersion Study Tour," *Global Business Languages*: Vol. 16, Article 7. Available at: <http://docs.lib.purdue.edu/gbl/vol16/iss1/7>

financial help for the development of different phases of the program. FIPSE supported the launching of the initial German and engineering Program; it supported the creation of its exchange program with the Technical University of Braunschweig in Germany, including its dual degree masters program; it supported the creation of the Spanish IEP model; and it supported the design and introduction of specialized, content-based language classes for students of engineering.

In more recent years, the IEP has been supported by the National Science Foundation, as URI faculty expanded the program's emphasis beyond the purely educational level to include multinational research projects. The NSF Program in International Research and Education (PIRE) was designed to impact scholarly research, but also the preparation of graduate students and young scholars, who, in the eyes of NSF, will no longer be able to compete without learning to work globally. In this spirit, several IEP faculty were able to pull an international team together, including partners from Germany, to develop new techniques for lab on chip technology. The project was to be both a scientific and educational effort, insofar as it was conducted by a cross-national team, with contributions from both sides. NSF supported this project for over six years with a \$2.5 million grant.

More recently the IEP and URI have been recipients of over \$1 million of support from the Department of Defense's National Security Education Program. By way of NSEP, URI has become a Chinese Flagship partner institution, meaning that it has pledged to develop a Mandarin Chinese program dedicated to language learning at the highest level. Chinese Flagship students must participate in intensive courses throughout their undergraduate years and spend an entire year studying and interning in China, leading to an almost native proficiency level of the language. The Chinese Flagship Partner Program, after a thorough review in November 2013, is now well underway to becoming a full-fledged Chinese Flagship Center. The encouraging news here is that engineers make the largest group of enrolled students in the URI program (with business students following closely behind). The fact that the Chinese Flagship program and the Chinese IEP were complementing each other in their respective expertises and recruiting strategies, has led to the success of this new program which due to its being able to create a curriculum and retention strategy for engineering students, makes it unique amongst its eight peers in the United States.

The IEP has also been generously supported by the German government with grants from the Economics Ministry and the German Academic Exchange Service. Both agencies have favored the IEP as a unique and replicable model for encouraging young American professionals to speak German, to feel at home in the German culture, and to be able to support the economic and business interplay between the two countries. Germany has been a willing partner with the IEP, as the program has been viewed as a new and effective paradigm for stimulating interest in Germany. The German IEP remains the most popular and largest of the IEP programs, and currently makes up 47.7% of the IEP enrollment.

The Economics Ministry's Program for Transatlantic Encounters has supported the IEP twice with sizeable three-year grants that enabled the program to expand, support its students abroad and develop a dual degree masters program with its partner university in Germany, the Technical University of Braunschweig.

The latter has been very successful and, as the first of its kind, has pointed the way for many other German-American university partnerships.

The German Academic Exchange Service (DAAD) has also been very supportive of the IEP. For several years it has contributed to the annual German Study Tour for younger IEP students, enabling them to get a first glimpse of Germany and the IEP partners in both education and business/industry. It has also provided outright grants to support the program, subsidies for the Annual Colloquium on International Engineering Education, and scholarships for some of the strongest students going abroad each year. In addition, the DAAD provides matching funds for a DAAD lecturer in the field of German as a Second Language (DAF) who is a welcome and needed addition to the faculty in URI's German section, and is being renewed every five years.

When the IEP decided to develop a program in Chinese, it also found a ready partner in the Chinese government. Representatives from the Chinese Consulate in New York were highly impressed with the idea of combining Chinese language learning with the study of engineering, and thus readily agreed to help create a credible Chinese language program at URI. The first step was support from China for a full-time faculty member in Chinese for three years, with the understanding that URI would then support the position from that point on. The Chinese also selected URI as a site for a Confucius Institute, to support the Chinese language program at URI and to provide information to the community about Chinese culture.

Partnerships with Universities Abroad

Because of the requirement that IEP students spend a semester of study abroad prior to the six-month professional internship, the program has developed close working relationships with universities in Germany, Spain, France, Mexico, Canada, and China. These university partnerships are reciprocal, meaning that students are exchanged in both directions on a one-to-one basis. Students take care of financial obligations at the home institution and then simply exchange places for that period of time. By mutual agreement, the partner institutions provide for the needs of the guest students, often designing courses for the specific needs of the students, and arranging specific research opportunities. IEP students at the Technical University of Braunschweig in Germany, for example, take language and culture courses along with at least one pure engineering course and a research project in one of the school's many research institutes. All work is conducted in the language of the host institution.¹³

The relationships with these partners abroad have matured over the years, as demonstrated by the introduction of dual degree graduate programs, and the exchange of faculty for both teaching and research purposes. Students and faculty, therefore, have benefitted by the transfer of knowledge and exposure to engineering as practiced in the academic setting of other nations. Taking classes in

¹³ Christina Neidert, "Sheltered Program at the Technische Universität Braunschweig, Germany. Facilitating Studying and Working Abroad: Best Practices," Online Journal for Global Engineering Education, Vol. 6, Issue 1, Article 3, December 2011.

a different setting and in a foreign language is a powerful path for students to acquire the skills implicit in the study of both the hard sciences and the humanities. The time spent abroad adds significant value to the education they receive at their home institution.

While there were initial fears about sending our engineering students to schools abroad, all of these evaporated once faculty had a chance to make mutual visits to the campuses of our partners. Each recognized the strengths of the others and found that they each shared the same concerns and goals for their students. At the same time, they recognized differences, most of which were found to be complementary to the strengths at home. Both faculty and students learned that they could benefit through interaction with peers abroad.

What are the Barriers to such Reform?

Despite the success of the IEP and its many admirers, the program has been imitated by very few. The problems begin with long-standing traditions in academia, as well as the innate desire to preserve the status quo. As mentioned above, language faculty view themselves as humanists, with their disciplines based in the study and teaching of national literatures. Many language faculty fear the notion that their language courses might be placed in the “service“ of other disciplines. On the engineering side, there are many who argue the superiority of English on the global scene and see no value in devoting time to learning languages other than English. Additional time, they argue, should be devoted to supplemental technical courses. These barriers can only be overcome if, as was the case at URI, the doubters begin to see the value of working together with faculty across the disciplines, leading to the understanding that both parties benefit through such collaboration. As a result of the IEP, both the language and engineering classes were soon full of very talented students, many of whom would not have attended URI if there were no such unique program.

Another major hurdle for the development of such innovative curricula is found in the nature of the faculty tenure and promotion system, which, by design, directly discourages faculty from committing time and effort to programs like the IEP. Language faculty are promoted as a result of good teaching, but not without publication records in their respective literature or language acquisition specializations. Engineers, of course, will not be tenured or promoted without a strong research record and success at attracting substantial outside funding. Faculty who involve themselves extensively in designing new curricula or promoting the partnerships required for an IEP place themselves and their careers in jeopardy. There is simply no motivation for faculty to become involved in such projects other than one’s own personal commitment to its value. Unfortunately, this is not sufficient to support widespread change.

It is also true that significant innovation in any organization requires visionaries with the sustained passion and commitment necessary to bring the desired change to fruition, and the relative freedom to do so. An example is the case of Hermann Viets and John Grandin who rapidly became consumed by the idea of the IEP, and who both were in a position to act. Viets was dean of his

college and thus unconstrained; Grandin had already been promoted to full professor and thus had the freedom to set his literary projects aside. Had they not met, had they not shared a common interest, had they not had the freedom to act, and had they not been successful opinion shapers, the IEP would not have come about. Change of this nature requires zealous champions, reliable partners, and leaders with credibility and the freedom to move forward.

Funding is another very real hurdle. Grandin and Viets needed funding to support travel as they visited companies in the U.S. and Germany to develop internships for their students. Grandin needed release time to commit to the project and to enable him, for example, to develop and offer separate introductory German courses for students of engineering. Funds to create promotional materials were also needed. Since there was no internal fund or seed money to get the program started, Grandin turned to the U.S. Department of Education and secured a FIPSE (Fund for the Improvement of Post Secondary Education) grant which supported all of the immediate needs and also lent prestige to the effort. Realistically, failure to find extramural support would have made the project undoable.

The lack of institutional commitment and support can also be a hurdle in the path of change. When the IEP was first in place, there was very little interest among URI administrators in international education, with the exception of Hermann Viets, thus leaving the full effort of the program in the hands of just a few faculty. Once the program had a longer track record of success and it had begun to attract attention and financial support from the private sector, however, the president took a greater interest in the project. Were we to start the program today, it would very likely find immediate administrative support, since the current president has designated global education as a major priority.

Overcoming the Challenges

We feel strongly that change such as is being suggested here must begin with recognition of the extent of the crisis in higher education today. Nothing will happen if the engineering faculty, for example, are blind to the rapidly evolving challenges of the contemporary workplace, are unaware of the high disciplinary standards and competition set by colleagues across the globe, especially in Europe and Asia. Nothing will happen if faculty are comfortable in their departmental silos, convinced that their classes will always be filled for their traditional lectures. And nothing will happen if language faculty are allowed to teach to the very few students who enroll in their esoteric upper-level classes, which have no direct relationship to the world of employment. Faculty in all disciplines must open their eyes to the problems facing higher education today and must reassess the roles that they and their disciplines can or could play in preparing young people for meaningful careers.

Incentive for change can come from institutional leadership. Faculty need to be encouraged by their presidents, provosts, and deans¹⁴ to think about the

¹⁴ See the supportive joint statement of the Deans of Arts & Sciences and the Dean of Engineering in "Bridging the Languages with Engineering: In Honor of John Grandin" in *Online Journal for*

university and its curriculum in a time of major change such as this. Institutional leadership is always “looking for stellar programs in which to invest”.¹⁵ A flagship program such as the IEP with its impressive success of garnering external support as well as several national awards both from the languages as well as from the engineering side¹⁶ provides such an investment opportunity. In addition, it gives the President, Provost and the collaborating deans a narrative, a story to tell which is unique and makes the university and its leadership stand out. Faculty should be encouraged to explore what students need to know in today’s society, to rethink their places in the educational curriculum, and not to fear reaching out to untraditional partners. A president, for example, could offer challenge grants and seed money to explore opportunities with potential partners, to research potential funding sources, and to experiment.

As mentioned above, incentive for change could also come from the federal government, for example, in the form of a Morrill Act for the 21st century. Just as President Lincoln reacted to the education needs for the age of industrialization, the current administration and Congress might seek to redefine the undergraduate curriculum for the age of globalization. There might, for example, be a certification process resulting in special funding for universities that could, for example, be certified as Morrill 2014 universities. Land Grant was a concept for its time, just as Sea Grant became a concept for its time in 1966, Space Grant in 1988, and Sun Grant in 2003. Morrill 2014 institutions would redefine liberal education by creative curricula through which students would acquire the benefits of both a technical/professional and liberal arts/global education. They would possess the skills to thrive in an era of rapid change, defined by modern technology and globalization.

With or without federal support, higher education leaders should and can take specific action to drastically change the rewards system for faculty, making it possible to commit themselves to programmatic ventures such as the IEP without endangering their university careers. One might, for example, allow faculty to pursue different tracks, with some focused more on teaching than research, with others more on research, and others on entrepreneurial program building. Given these options, one might even build flexibility into the system so that a research faculty member could, for example, devote five years to the teaching track or the administrative track. Such five-year blocks could be defined by contract, with very clear duties and expectations. All of these professional strands would be acceptable as steps toward tenure and promotion, assuming that certain predefined standards are met.

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Available at: <http://digitalcommons.uri.edu/ojgee/vol6/iss1/>

¹⁵ Mark Roche, “Ensuring a Flourishing (German) Department: A Dean’s Perspective,” in *German Quarterly* 84.4 (Fall 2011) p. 416.

¹⁶ The IEP and its directors have received awards from ABET (Educational Innovation Award), IIE (the Heiskell Award for Innovation in Study Abroad), ADFL and MLA (2012 Award for Distinguished Service in the Profession), NASULGC (Michael F. Malone Award), the German government (Federal Cross of Honor), the German Academic Exchange Service (DAAD Alumni Award for International Exchange), AATG (Outstanding German Educator), and NAFSA (Senator Paul Simon Spotlight Award for Campus Internationalization).

Administrators should also provide more than lip service for interdisciplinary teaching and programming. It could be made much easier for faculty to have joint appointments, and for programs such as the IEP to be at home in both a College of Engineering and a College of Arts and Sciences. Deans should be prepared to co-fund projects which are in the interest of both colleges. They should be prepared to jointly mentor and evaluate faculty participating in cross-disciplinary programs.

The administration should also be prepared to help faculty overcome university bureaucracies that are, by design, only equipped to deal with the status quo. Faculty can easily be discouraged by institutions which do not embrace attempts to do things differently and have little room for experimentation in the curriculum. The IEP survived by persisting in the face of resistance when proposing, for example, two degrees (BA/BS) in five years, or attempting to streamline the general education program for IEP students, or creating dual degree masters programs with partner schools abroad, or even accepting financial support from the People's Republic of China. It is an unfortunate reality that institutions often say "no" in the face of common sense proposals, when they should be saying: "Now this makes sense. How can we make this happen?" Would it not be possible to appoint an innovation board, i.e., a group of faculty and administrators who are pledged to help their school's academic entrepreneurs?

To encourage cross-disciplinary teaching, administrators should require all faculty to participate in general education curricula. It would be important, for example, for engineering faculty to offer engineering courses for non-science majors, or engineering courses for an engineering minor or engineering Bachelor of Arts degree. Science faculty should do the same, as should pharmacy and medical school faculty, and law and business faculty as well. No humanities or social science student should be allowed to graduate without sufficient background in science and technology to comprehend and appreciate those things which drive our economy and impact our daily lives. Likewise, no engineering student should be allowed to graduate without exposure to engineering as practiced abroad and through global teamwork, and without demonstrating the acquisition of strong communication skills, problem-solving skills and a commitment to lifelong learning.

Administrators and faculty should be continually networking with leaders from the private sector who will be hiring their graduates. New curricula should be developed with the advice and counsel of leaders from business and industry, and the latter should also be expected to help finance the education of their future employees. Students of our programs should be able to find appropriate internships where they can learn but also receive valuable feedback. If such a network is active, we should never hear that our education system is not producing graduates with the skills needed for the workplace and for the 21st Century. And we should no longer hear that 50% of our graduates are unemployed or underemployed.