Globalizing Engineering Education

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Recommended Citation
Berka, Sigrid, "Globalizing Engineering Education" (2015). CUNY Academic Works.
http://academicworks.cuny.edu/ufs_conf/11

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Globalizing Education Conference
City University of NY University Faculty Senate
April 24, 2015
Globalizing Engineering Education
Sigrid Berka, Executive Director,
International Engineering Program
The Crisis in U.S. Higher Education

• Value of a university education in doubt for first time in US history
  • Academically Adrift (Arum/Roksa, 2011)
  • Thiel Foundation
  • Siemens/ Stihl (dual system education)

• Over 50% of college grads un- or under-employed saddled with enormous debts
• Dwindling support from State governments, hence rising tuition costs
• How Can American Higher Ed adept to the needs of today’s global society?
In the Spirit of the Morill Act

• Morrill Act signed in 1862 by Abraham Lincoln to create land-grant colleges and universities

• Concern: to educate young people for the needs of their times, largely defined by industrial revolution, but not at the expense of sciences or classical studies

• Goal: “to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life”
Solving the Crisis in U.S. Higher Education?

• By preparing students for what is needed in the global work place
• By considering their return on investment
• By exposing liberal arts majors to science & technology; and STEM majors to arts & humanities

• Through an integrated curriculum which partners STEM disciplines with the Arts & Humanities
• Through partnerships across the disciplines, between private and public sectors, between U.S. and universities abroad
Can the IEP model inspire a new vision of education for the global society?

– Rooting Language learning in many subject areas (LAC)
– Creating change in the profession by bridging the Colleges of A&S and Engineering
– Giving language learning, experiential learning and study abroad a purpose (career, competitiveness)
– Creating a model to boost language, engineering and study abroad enrollment
– Making corporate and private donors full partners
IEP model:
Marriage of engineering, language study & applied research abroad produces bilingual engineers

Giving the powerful and formative study abroad experience to students by recognizing the need to
– challenge one’s world view, values and assumptions
– keep the nation informed and competitive
– reshape instruction in Lang. & Lit by applying it to real world contexts (ACTFL’s 5 ‘Cs’ standards)
– reshape engineering education by exposing students to real world scenarios (ABET guidelines)
– advise, mentor, nurture dual degree students
International Engineering @ URI
Bridging the languages with engineering

• 5-year Dual Degree
• B.S. in engineering discipline
• B.A. in Chinese, French, German, Italian, Spanish

• one full year of immersion abroad (study/work)
Semester Abroad at a Partner University

China - Zhejiang University
Chile – Pontificia Universidad Catolica de Valparaiso (PUCV)
Germany – Technische Universitaet Braunschweig
France - Université de Technologie de Compiègne
Mexico - ITESM Monterrey & Toluca Campuses
Spain - Universidades de Zaragoza, Navarra, & Cantabria
6-month Paid Internship Abroad

- Usually in fourth year
- Engineering skills
- Cross-cultural skills
- Language skills
- Experience engineering in other contexts
- Wages cover housing & food
- IEP partners with over 35 global firms
IEP Statistics

~345 Undergrad IEP students enrolled (1<sup>st</sup>-5<sup>th</sup> yr)

> 1/4 of all engineering undergrads are IEP students

(= 25 % of College of Engineering)

~1/3 are women

500+ graduates since 1987
NSF PIRE grant to develop dual masters/dual PhD program

- 2.5 million NSF-PIRE grant to URI to foster international research and education collaboration with Technical University of Braunschweig (TU-BS)
- German Government Grant
- MaxKade Foundation Grant
- MS degree from URI and Diplom or MS from TU-BS
- PhD from URI and Dr.-Ing. from TU-BS
- Two advisors, two committees, two defenses
- Based on recognition of equivalencies (course, tuition, etc)
German: ++0%
Spanish: +8.54%
French: +5.06%
Chinese: +8.25%
Italian: +5.71%

01-02: 164
02-03: 164
03-04: 178
04-05: 187
05-06: 194
06-07: 210
07-08: 222
08-09: 252
09-10: 354
10-11: 278
11-12: 318
12-13: 35
13-14: 167

The University of Rhode Island
Exchange Balance University of Rhode Island – Technische Universität Braunschweig, 1995-2014

URI mostly IEP bachelors (1 semester), TUBS dual master candidates (one year)
Accepted job offer at Hexagon in North Kingston, RI

Fall of 4th year
Studied computer engineering at Zhejiang University in Hangzhou

Spring of 4th year
Internship with Hexagon Metrology in Qingdao, China

Summer after 3rd year
Internship with Hexagon Metrology in North Kingstown, Rhode Island

Fall of 4th year
Studied mechanical engineering at Technische Universität Braunschweig

Spring of 4th year
Internship with Hexagon Metrology in Wetzlar, Germany

 Completing 5th year at URI with a capstone design project while concurrently interning at Hexagon for a few hours a week

Accepted job offer at Hexagon in Michigan

Christian Marks ‘13

Sean Taylor ‘13
Maximizing preparation for global work force (Sheida Danesh, Mech. Eng. & German)

- Begin working at Hexagon Metrology in Rhode Island (also known as Brown and Sharpe) 
  Summer after 2nd/3rd yr.

- Arrival in Germany for year abroad 
  Fall 4th yr.

- Begin studying at TU-BS and working at Metrology Research Institute 
  Fall 4th yr.

- Begin MCE 401 Capstone Design Project sponsored by Hexagon Metrology 
  Fall 5th yr.

- Globalize- Begin 6 month internship at Hexagon Metrology in Germany (also known as Leitz Messtechnik); design of new temperature sensor 
  Spring 4th yr.

- GRADUATE SCHOOL: MIT
  AFTER GRADUATION
Short J-Term Abroad (12 days)
Chile, France, Germany Study Tours in January
DB train design workshop in Frankfurt

DB train maintenance center
Team member builds train
Design Study Abroad in synergy with recommendations by professional associations (MLA, ACTFL, ABET)

• **Develop more broad based approach to FL major that moves beyond literary studies** > “Foreign cultural literacy” (Berman)
  
  (only 6.1% of students declaring a language as 1st major go on to get a Ph.D.; 94% study languages for purposes other than becoming language/lit scholars)

• **Support a broader curriculum by alliances with other departments**

  to reinvigorate language departments as central units in the humanities

• **Make language study more intellectually attractive and more pragmatically relevant**

  for students whose primary interests may not include a foreign language

*Foreign Languages and Higher Education: New Structures for a Changed World
2007 MLA Ad Hoc Committee on Foreign Languages*
ABET criteria re: student learning outcomes

- (a) an ability to **apply** knowledge of mathematics, science, and engineering
- (b) an ability to **design and conduct experiments**, as well as to analyze and interpret data
- (c) an ability to **design** a system, component, or process to meet desired needs **within realistic constraints** such as **economic**, **environmental**, social, political, ethical, health and safety, **manufacturability**, and sustainability
- (d) an ability to function on **multidisciplinary teams**
- (e) an ability to identify, formulate, and **solve engineering problems**
- (f) an understanding of **professional and ethical responsibility**
- (g) an ability to **communicate effectively**
- (h) the broad education necessary to **understand the impact of engineering solutions in a global, economic, environmental, and societal context**
- (k) an ability to use the techniques, skills, and **modern engineering tools necessary for engineering**
Impact on URI campus:
a model to save the languages and expand study abroad

• Enormous impact on the URI campus most visibly in extraordinary enrollment in langs.:
  – 145 Spanish majors, 135 French and 164 German majors, 25 Chinese majors

• 25% of engineering students major in a FL and go abroad for one entire year
  – (as opposed to 4.1 % US eng. students going abroad; 0.1 % for entire calendar year) – *IIE Open Doors report 2014*
Implementation and Follow-through: Leading the Cause of International Engineering Education

- Going against all odds
  - Command respect by engaging faculty and students
  - Tactfully defying skeptics by showing benefits for all
- Building networks at URI and beyond
  - Leadership in internationalizing URI
  - Going outside for support (Title IV, FIPSE, NSF, IGERT, German Ministry, Hanban, corporate and donor funding)
  - National Leadership position of the IEP (Dissemination, Colloquium, Consulting, Outreach)
  - Administration wants to invest in and nurture stellar programs (GQ, Fall 2011, Mark Roche)
German BA/BS Majors Enrolled
(Monatshefte, Vol 102, No. 4, Winter 2010)

- University of Michigan: 184
- University of Rhode Island: 124
- Indiana University: 98
- Ohio State University: 92
- University of Connecticut: 87
- University of Oregon: 85
- University of Arizona: 83
- Michigan State University: 77
- University of North Carolina, Chapel Hill: 72
- Brigham Young University: 71
- University of Wisconsin, Madison: 67
- University of Portland: 62

Number of Students enrolled
Alumni Survey to 221 GIEP graduates >`93:
Impact of IEP with one year immersion abroad on their career

Positive impact of IEP program

- Strong impact on my entire career: 56%
- Strong impact on my early career: 15%
- Moderate impact on my entire career: 15%
- Moderate impact on my early career: 7%
- No impact on my career: 7%
How important was your international experience in earning your first job offer?

- 17% It was the decisive factor
- 42% It was an important factor
- 30% It was not a very important factor
- 11% It was not important at all
“In global, multicultural organizations, simply expecting all employees to speak one common language, such as English, marginalizes the potential impact of international talent and leave monolingual staff ill-equipped to help the organization compete effectively in a globalized environment.”*

*Forbes Insights Report July 2011 on Reducing the Impact of Language Barriers
Language skills,..., have a critical role to play in the development of a truly globalized workforce. The challenge we face as business people, as educators and as government leaders is to make sure that Rhode Islanders have the skills and mind-set they need to successfully meet increasing demands from the global marketplace as well as the demands from an increasing diverse and multi-lingual clientele in Rhode Island. *

*Tom Wroe, CEO Sensata Technologies Rhode Island Language Summit Dec. 7, 2011 Providence
Colloquium on International Engineering Education

Please register for the 18th Annual Colloquium on International Engineering Education

November 5-7, 2015
New York City
Organized by IIE & German Academic Exchange S.
IEP Marketing survey for first yr. students:
What about the IEP made it stand above other engineering programs you were considering?