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Introduction to and Experiences with the Undergraduate GEARE Program

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The Global Engineer is...

- Prepared for Globalization of Manufacturing Industry
- Able to Function on Global Teams
- Understands Engineering in Global Context
(Environment, Sustainability, Economics)
- Versed in Global Product Platforms
- Appreciative of other Languages and Cultures
- Proficient in Tech-based Global Enterprise Culture
- Prepared for /Desires International Assignment

State of Globalization

- Very small percentage of Engineering and Science university students have substantial international engineering experience before graduating
- The barriers, real and perceived, are:
 - » Cost
 - » Graduation time
 - » Community (language, leave family and friends)
- Innovative programs must be designed before engineering students will reach a substantial level of global professional competency before they graduate

Program Design Issues

- Time to graduation – no impact
- Financial costs to students – no impact
- Second-language competencies – optimize available curricular options
- Co-located and intercultural teams – a priority
- Global workplace engineering experience – a priority
- Engineering design opportunities – a priority

Overview of Undergraduate GEARE Program

- Key features:

- » Minimum of four semesters of foreign language before going abroad
- » Orientation in foreign culture before going abroad
- » Domestic internship first
- » Subsequent international internship with the same company
- » One semester of study abroad with fully transferable course credits
- » Two-semester design team project
 - One semester abroad, one semester at Purdue
 - Multi-national, multi-university design teams working on industry-inspired projects

Strategic University Partners

- Purdue University, West Lafayette, Indiana, USA
- Universität Karlsruhe, Karlsruhe, Germany
- Shanghai Jiao Tong University, Shanghai, China
- IIT Bombay, Mumbai, India
- Tec de Monterrey, Monterrey, Mexico



Strategic Industry Partners

- Current
 - » Cummins
 - » John Deere
 - » Ford
 - » GM
 - » Shell
 - » Siemens
 - » United Technologies (Otis, Pratt & Whitney, Carrier)
- Under discussion / in negotiation
 - » Daimler-Chrysler
 - » GE
 - » Kimberly-Clark
 - » ...

What we request of Industry Partners

- Commit to help us globalize student experiences
- Offer suitable projects plus mentoring for the global design team courses
- Recommend students for the program from pool of interns
- Provide domestic and international internships to 1+ Purdue student per year
- Provide domestic and international internships to 1+ Int'l Univ. partner student per year
- Provide financial support (scholarships, short courses, faculty exchange, administration)

Schedule of Undergraduate GEARE Program

For Purdue Students

1st Sem.	2nd Sem.	1st Sum.	3rd Sem.	4th Sem.	2nd Sum.	5th Sem.	6th Sem.	3rd Sum.	7th Sem.	8th Sem.
Regular Freshman Semester	Regular Freshman Semester GEARE Selection	May-semester course at Partner Univ. Foreign Language 1	Regular Sophomore Semester Foreign Language 2	Regular Sophomore Semester Foreign Language 3	Domestic Intern-ship with Strategic GEARE Partner	Regular Junior Semester Foreign Language 4 Cultural Orientation	Internat'l Intern-ship with Strategic GEARE Partner Study Abroad Semester 1st Semester of Global Design Team Project		Regular Senior Semester	Regular Senior Semester 2nd Semester of Global Design Team Project

Student Participation

	Universität Karlsruhe	Shanghai Jiao Tong University	IIT Bombay, Mumbai	Tec de Monterrey	Total
2003	6 Purdue 9 Karlsruhe				6 Purdue 9 Partners
2004	9 Purdue 8 Karlsruhe	1 Purdue 1 SJTU			10 Purdue 9 Partners
2005	7 Purdue 9 Karlsruhe	5 Purdue 5 SJTU	1 Purdue 0 IITB		13 Purdue 14 Partners
2006	4 Purdue 4 Karlsruhe	5 Purdue 5 SJTU	2 Purdue 2 IITB	1 Purdue 0 Tec	12 Purdue 11 Partners
2007	6 Purdue 6 Karlsruhe	4 Purdue 4 SJTU	1 Purdue 1 IITB	1 Purdue 1 Tec	12 Purdue 12 Partners
2008	(12) Purdue ? Karlsruhe	(4) Purdue ? SJTU	(4) Purdue ? IITB	(3) Purdue ? LA	(23) Purdue ? Partners

Faculty Participation

	Universität Karlsruhe	Shanghai Jiao Tong University	IIT Bombay, Mumbai	Tec de Monterrey
2003	Eckhard Groll			
2004	Chuck Krousgrill			
2005	Peter Meckl	George Chiu		
2006	-	-	-	-
2007	Steve Wereley	Bin Yao	-	-
2008	?	?	?	?

Financial Support

- Endowment of \$600,000 by retired Siemens VP
- Seed grants from International Office at Purdue
- Industry partners pay yearly participation fee
- Funds are spent on:
 - » Travel stipend for students (\$3000-\$5000)
 - » Equalization of student internship salaries
 - Make different GEARE locations equally attractive
 - » Administration
 - » Travel by administrators

Quality of Student Participants

- Very good GPAs: 3.7 on average (Several 4.0's)
- Typical honors include:
 - » Outstanding Graduating Engineer 2004
 - » Purdue President's Leadership Class (30 of 7,144)
 - » Mauzy Emerging Leaders Program (60 of 7,144)
 - » National Merit and Indiana Top Resident Scholar recognition
 - » 4 Class Student-of-the-year Awardees, 2 HS class Presidents, 1 student rep of local HS Board (1 of 1200)
- Average of 4.5 semesters of university-level language courses by the time they study abroad
- Several students lived abroad
- ~26% women, compared with 13% overall in ME

Student Feedback

- Cultural differences had significant impact on their interactions
- Ability to accommodate to changes in a foreign environment improved with experience
- As they became more confident in new environment, productivity increased
- German students likely to adapt more readily to cultural differences due to familiarity with US culture through mass media
- US students, in contrast, emphasized a much greater personal change due to adaptations to cultural differences
- English was the language of last resort in communications between members of both groups.
- US students indicated that German language skills improved considerably in both social and business settings
- Overall, development of communication skills was considered best outcome

Summary of Undergraduate GEARE Program

- Outstanding Students Apply to Program
- 2-3x more ME Women in GEARE than Overall
- Internships and Study Abroad worked
- Multi-semester, Multi-national Design Team Project worked very well
- Curriculum Articulation is necessary, but only a start
- Faculty participation is critical, research collaborations will be imperative
- Scale-up (ME, AAE-KA, ECE-SJTU, CHE-IITB)

Summary of Undergraduate GEARE Program, cont'd

- Administration is time intensive
- Close interactions between partner university and Purdue is a must
- Selection of students is critical
- Resident faculty was significant help to start program
- Overall program has become extremely valuable experience for students
- Our goal:
 - 10 Purdue ME students per year per partner university
- Expansion to other engineering disciplines in progress

Summary of Undergraduate GEARE Program, cont'd

- Upon completion of the following requirements, students will receive **Certificate in Global Mechanical Engineering Competency**
 - » Completion of 12 credits in one foreign language program
 - » One semester of study abroad at partner university
 - » One three-month domestic internship at industry partner
 - » One subsequent three-month international internship preferably, but not necessarily, at the same industry partner
 - » Successful participation of two-semesters of co-located global design team projects
 - One semester at partner university and one semester at Purdue
 - » GPA of 3.0 or higher upon graduation with the BSME degree

Global Design Team Projects

- 2003/2004:
Design and fabrication
of a fully-functional,
portable, four-person
carousel



- 2004/2005:
Design and construction
of an autonomous off-
road vehicle prototype



Global Design Team Projects, cont'd

- 2005/2006:
Design and construction
of a tennis ball throwing
machine

