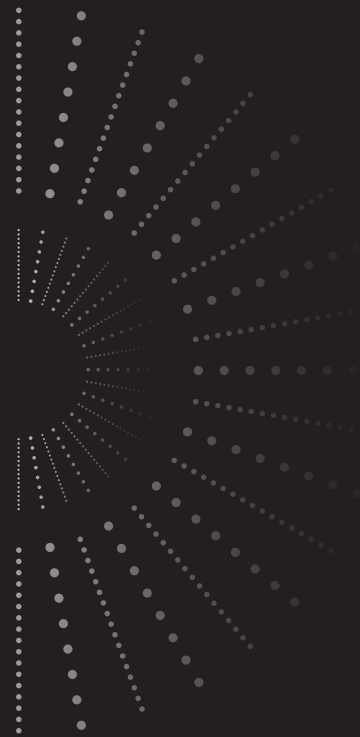


# PURDUE GEARE IMPACT REPORT

An Outcomes  
Assessment Report  
of Student Global  
Competence Development

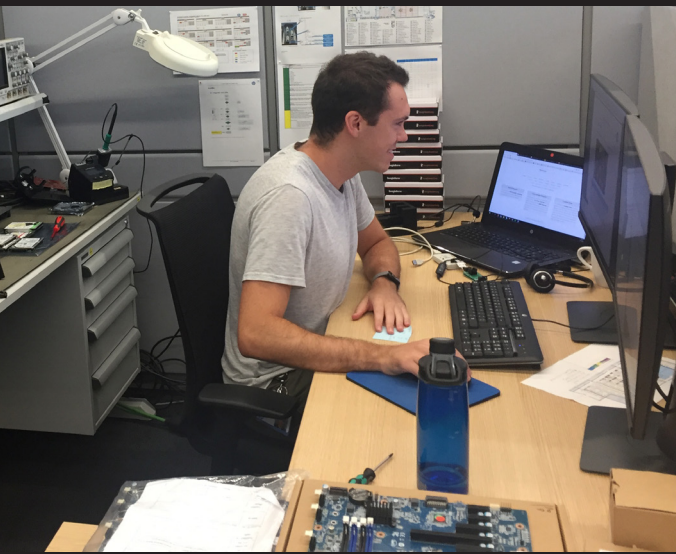




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Whether the workplace context is deeply multinational or quite localized, quality engineering demands professionals who are skilled at "...working effectively with people who define problems differently<sup>1</sup>." Employers in the US and around the world recognize that so-called 'soft' (interpersonal) skills are critical to staff integration, team productivity, customer trust and generating repeat business<sup>2</sup>. Employers often also articulate feeling that these skills may be "...un-trainable in the workplace<sup>3</sup>." This report uses mixed methods techniques to analyze the soft-skill outcomes of one of Purdue's flagship career-preparation programs for engineering students, e.g. the GEARE (Global Engineering Alliance for Research and Education) program.

## Executive Summary

Findings indicate that the Purdue GEARE program is exemplary in fostering students' growth in intercultural and domestic inclusivity competence, as well as in teamwork and leadership.

### Quantitative Findings

- Mean gain of 13.65 IDI points (almost one full cultural effectiveness stage).
- Individual growth as high as 49 points (more than 3 stages).
- 82% of those who started in Polarization moved into higher stages of effectiveness.
- Quadruple the growth rate of Comparison Group; twice the growth rate of Control Group.

### Focus Group Findings

#### 1. Interpersonal:

"If you are hard to work with, it will hinder your advancement on a team."

"If you have patience, you can absorb constructive criticism instead of avoiding what [your boss or teammate] is saying."

#### 2. Leadership:

"By embracing the differences [in viewpoint], you can come to better decisions."

"I have a much better ability to handle stress; to work in uncertainty."

"Work ethic [is what I learned]: you don't finish until it's really finished."

<sup>1</sup> Downey et al, 2006; p. 107

<sup>2</sup> British Council, 2013

<sup>3</sup> Stevens and Norman, 2016. p.1

## Introduction

Since 2003, the Purdue Global Engineering Alliance for Research and Education (or “GEARE program”), a unique collaboration between multiple world-class engineering universities and strategic industry partners, has undertaken to create work-place ready graduates who are as proficient in people management and teamwork as they are in the technical and analytic skills of engineering. As GEARE approaches its 20th anniversary, its most recent innovation has been to provide participants with individualized mentoring in working effectively and appropriately across interpersonal, intercultural and inter-ethnic differences. In the paragraphs to follow, this report will briefly discuss GEARE’s instructional structure and developmental model, the research methods, and findings on the program learning outcomes, in comparative perspective.

Source: Educating Globally  
Competent Difference Makers:

A Report of the Global Competency  
Task Force, Purdue College of  
Engineering (2015)



## Instructional Structure

Purdue’s GEARE program was designed to allow engineering undergraduates to integrate all of the following into the course of a normal four-year undergraduate degree program:

- a) foreign language study,
- b) at least one semester of study abroad (usually during the junior year);
- c) two internship or research experiences; one in the US and one overseas, and
- d) a global design team experience.

In this, it is conceptually similar to internationalized engineering tracks at other elite US engineering schools, such as Worcester Polytechnic and Georgia Tech. Beginning in 2015, GEARE leaders also instituted a required three-course sequence (beginning at the start of the junior year) designed to ‘super-charge’ students’ acquisition of the soft skills of intercultural and inclusive teamwork. This decision came in response to research indicating that, without intentional ‘cultural mentoring,’ these skills do not, in fact, reliably improve for the majority of semester abroad or year abroad participants<sup>4</sup>. This is problematic for engineering since ABET standards call for ethical interpersonal and global proficiencies in addition to technical abilities.

<sup>1</sup> Downey et al, 2006; p. 107

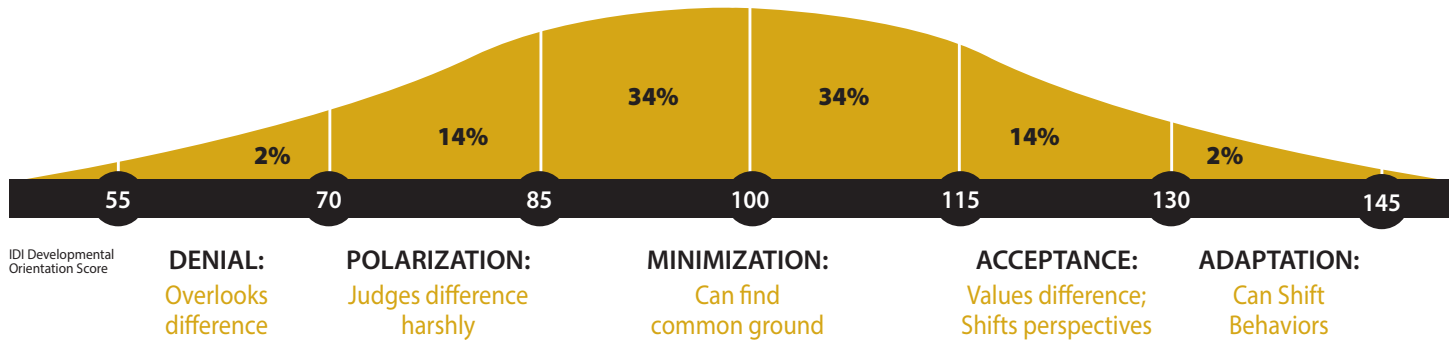
<sup>2</sup> British Council, 2013

<sup>3</sup> Stevens and Norman, 2016. p.1

<sup>4</sup> Downey et al, 2006; p. 107 British Council, 2013 Stevens and Norman, 2016. p.1 Ruth Churchill, writing in 1958 about outcomes of the Antioch junior year abroad program in France was perhaps the first researcher to report that “...some students have not changed at all, and others have become more narrowly American and critical of foreign values...” (p.447).” For more quantitative analyses of education abroad outcomes, see also: Vande Berg, Paige & Lou (2012), Student Learning Abroad: What Our Students are Learning, What They’re Not and What We Can Do About It; Sterling, VA: Stylus.

## Developmental Model

Many college opportunities seek to improve participants' skills in the realms of cross-cultural or diversity sensitivity by focusing on knowledge acquisition, assuming that appropriate and effective behaviors will follow. Yet interpersonal actions and behaviors are deeply rooted in an individual's value systems and the attitudes derived from them. In order to bridge from cognitive knowledge to effective interactions across difference, learners need mentor-assisted practice<sup>5</sup> in developing the interpersonal and leadership skills illustrated in the pyramid model above. These bridging skills include: (a) communicating effectively across disciplinary and personal difference, (b) enacting cross-cultural respect, sensitivity and humility, (c) practicing openness and tolerance of ambiguity, and (d) the analytical, observational and interpretive skills of critical thinking (as applied to group dynamics, not just to technical problems). GEARE's new three-course sequence was intentionally designed to develop these skills in its participants. See appendix for information about course content.



## Research Instruments

This report uses matched pre and post study abroad survey outcomes of GEARE students, which were evaluated alongside matched survey outcomes for both a comparison and a control group. We also used focus group techniques with selected GEARE students approaching graduation.

Our focus group protocol asked students to define the 'soft' skills of engineering as they had experienced them, to relate how they had changed through GEARE participation, and to reflect on and recount a GEARE experience in which they had to adapt to another culture. We provided no preset definition of "soft" or "intercultural" skills. Data saturation<sup>6</sup> was reached at the conclusion of three rounds of focus group research, involving twenty seniors. These included fourteen male students and six female students, of whom a dozen were U.S. citizens.

Within the GEARE program, progress towards intercultural/inclusivity competence is measured regularly using the Intercultural Competence Inventory (or "the IDI"), a 50-item on-line survey.

Rigorous research has shown this instrument to have very little social desirability bias<sup>7</sup>, and to be free from intentional or unintended racial, age, gender and social hierarchy biases<sup>8</sup>.

The IDI situates a person's ability to work effectively across difference, according to a five-stage developmental continuum, arising from grounded theory research<sup>9</sup>, as shown above. Our sample of matched IDI scores came from forty-five GEARE students. Outcomes and patterns of growth were compared to matched-pair IDI outcomes of two analogous undergraduate cohorts:

- a comparison group of forty Purdue STEM students who participated in one of several non-GEARE multi-semester skill development programs, each of which included team-based globally-oriented project work combined with short-term study abroad, and
- a control group of fifty-two Purdue students who participated in a semester of study abroad, without the GEARE three-course intercultural mentoring sequence.

<sup>5</sup> Paige and Goode, 2009.

<sup>6</sup> Guest, Namey & McKenna, 2017.

<sup>7</sup> Paige et al, 2003.

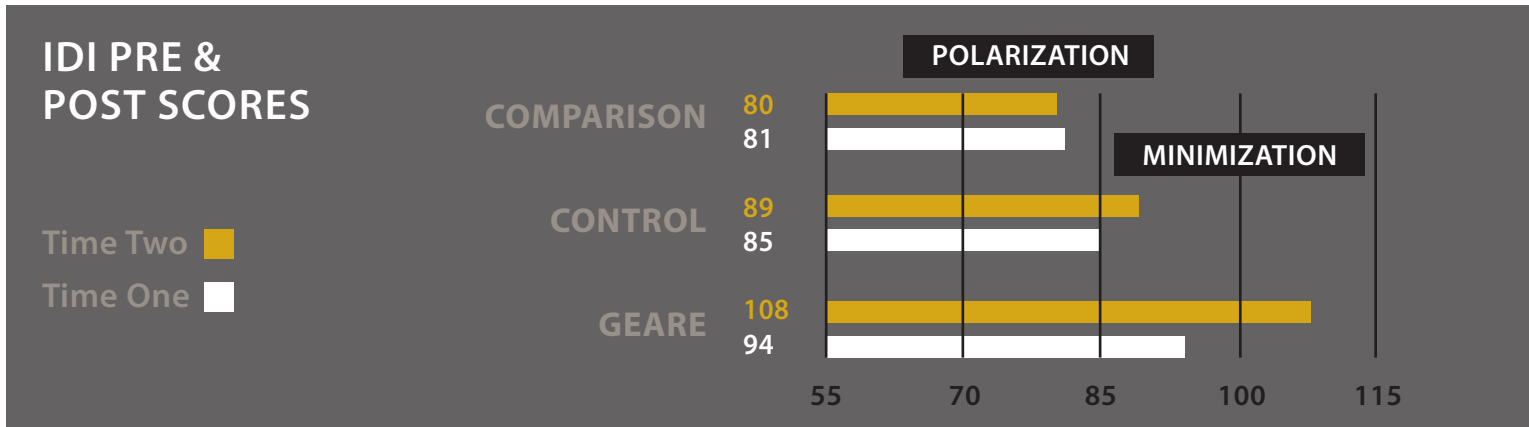
<sup>8</sup> Wiley, 2017.

<sup>9</sup> Hammer, Bennett & Wiseman, 2003.

## Findings

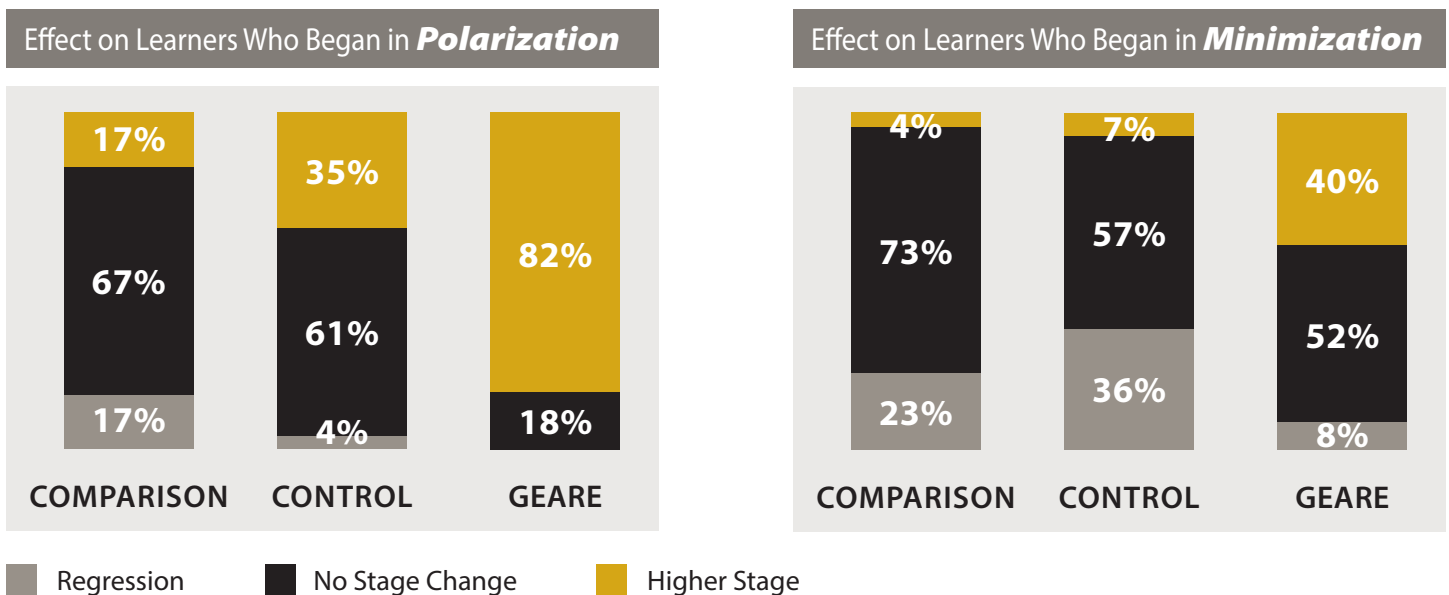
### Intercultural Development Inventory Results

The chart on the following page shows the mean pre and post IDI scores for all groups. Note that both the control group and the comparison group started at a mean IDI score in Polarization (and moved forward only a few points), while the GEARE group started in Minimization and showed a mean forward change of 14 points. These data are consistent with other disparities between mentored and un-mentored intercultural learning experiences, as shown in the research literature<sup>10</sup>. We found no significant difference in Time One IDI scores between GEARE students of differing genders or nationality groupings (US vs. International).



### Reducing Polarization in the Workplace

The ability to avoid “judgmental-ness” and find common ground (e.g. the skill which distinguishes Minimization from Polarization) is critical to good client relations, employee retention, effective teamwork and a thriving sense of shared mission or purpose. However, individuals or groups in Minimization have a low capacity to work effectively across deep differences, to innovatively problem-solve or to weather institutional change. In order to do these things well and consistently, a team needs at least a few peer leaders who are in Acceptance, the stage in which appreciating complexity, maximizing team members’ differing ‘super-powers’ and critically examining one’s assumptions, even under pressure, is second nature. The charts shown compare GEARE program effects to those of multi-semester team mentoring (Comparison) and un-mentored semester abroad (Control) for moving learners out of Polarization into Minimization (or above) or out of Minimization into Acceptance or Adaptation.



<sup>10</sup> Vande Berg, Paige & Lou, 2012.

## Focus Group Data: Beyond “Generic” Job Skills

While the scores from the IDI indicated that GEARE students are making great strides in developing comfort at working across difference, we wanted to know more about how this played out in real-world settings. Therefore, we designed the focus group questions to elicit examples of having put non-technical skills into practice in the workplace, in a country in which the student had not previously worked or lived. The competencies required of a STEM graduate in the workplace can be thought of as ranging from the technical or “visible” skills, such as facility with mathematical modelling, to the soft or “invisible” skills such as social awareness<sup>11</sup>. See chart to for a visual representation of this continuum.

### “VISIBLE” SKILLS

#### TECHNICAL SKILLS

Programming

Data Fluency

Problem-Solving

Design

Etc.

#### GENERIC SKILLS

Time Management

Priority-Setting

Accountability

Initiative

Etc.

#### TEAM SKILLS

Collaboration

Communication

Flexibility

Negotiation

Etc.

### “INVISIBLE” SKILLS

#### EMOTIONAL INTELLIGENCE

Empathy

Self-Awareness

Motivation

Self-Regulation

Social Awareness

Not surprisingly for a group of engineering students, the practical examples they recounted indicated problem-solving skills that will transfer well to any work environment. For example:

“ I had to design something that needed to get machined and the machinist did not speak any English. My German wasn’t good enough. Any discrepancies would have caused errors. We quickly figured out a need to effectively communicate the exact requirements. Body language and hand gestures can really be very impactful. Being resourceful is necessary: using translating software; asking for the help of another expert, etc. The end goal is getting stuff done. ”

The focus group responses also revealed skill development in three notable areas that are much in demand in the workforce<sup>12</sup>: Leadership, Teamwork and Emotional Intelligence.

### **Leadership Skills: Confidence, Ambiguity-Tolerance and Critical Thinking**

The structure of the GEARE program gives all participants a first internship experience in the summer between the sophomore and junior years of study. In other words, they have all had a chance to work on generic work-place skills (e.g. time management, priority setting, etc.) well before their overseas study and internship placement. Not surprisingly, then, the focus group findings suggest that the mentored overseas experience helps GEARE students develop higher-order job skills, such as confidence and tolerance of ambiguity. Multiple students described the confidence-building effect of the GEARE program in ways that were similar to this quote:

“ For me the biggest positive is being comfortable with feeling uncomfortable. We were thrown half way around world and expected to go above and beyond...[and now] Any challenge that I get put in by a company I will be able to overcome. ”

<sup>11</sup> Luca & Tarricone, 2001.

<sup>12</sup> NACE, 2018





Studies of career skills needed by US employers frequently cite lack of critical thinking in today's graduates as a matter of deep concern<sup>13</sup>. As defined by subject-matter experts,<sup>14</sup> 'critical thinking' is conceptually distinguished from 'problem solving' by the ability to recognize the impact of one's own experiences and preferences as a contextual factor that may lead to poor decision-making. As described by one of the focus group participants, critical thinking is:

“ [The] ...ability to propose and listen to ideas without any biases. You can live your life and always have the bias glasses on. And someone may present a solution in a slightly different manner and [a critical thinker] can see its benefits. ”

The GEARE program has helped students learn to suspend judgement and enact critical thinking when differences of opinion or approach occurs, as the following statement describes:

“ When the experiences happened I knew it was cultural differences and not just me not liking the person. [The GEARE mentoring courses]...helped me think through what might be causing discomfort and misunderstandings. ”

### ***Team Skills: Rapport-building, Collaboration and Communication***

Learning to work effectively in multicultural or multinational teams is not an easy thing.<sup>15</sup> Students credited the GEARE experience with improving their rapport-building, collaboration and communication skills. For example, they pointed out that the 'stereotypical' engineer is not very socially adept, therefore it is important "...to be social enough that you can actually be somebody that people enjoy working with." The following story is representative of the group's shift in ability to put this realization into practice:

“ Before I went abroad with GEARE, I had worked on group projects and I was totally ok with not knowing anything about my fellow group members. Now, I ask more questions, I am more curious. I learned that in Spain. Being willing to listen and care and interact with others is really beneficial to team relations. ”

Engineers from elite universities are not necessarily known for being humble or consensus-oriented. More than one GEARE participant had learned, however, to understand the social value of flexibility, as illustrated by this comment:

“ I am much better at self-reflection and understanding when my idea might not be the best idea. It's a big switch for me to say 'my idea is justified but your idea also works and I think we should go with it. ”

<sup>13</sup> NACE, 2018

<sup>14</sup> <https://www.aacu.org/value-rubrics>

<sup>15</sup> Pfaff & Huddleson, 2003.



GEARE participants also felt they had made advances in their communicative abilities; defined not merely in terms of foreign language proficiency, but in terms of style flexibility, capacity for empathic listening and self-assurance. One student talked about how, after struggling to use a foreign language in professional contexts, being back in his native USA had contributed to a “power up” effect in terms of his public speaking confidence. Several had learned that:

“ Listening is an important soft skill ...respect the other person so he can respect you and it leads to good decision making.”

Multiple students also mentioned having learned to take the interpersonal and productivity implications of differing conversational approaches into consideration, for example:

“ I think of [communication styles] more in a work context. It applies anywhere. If my boss communicates to me in a certain way. My boss might be from China or from Spain. My boss might be firm or not direct; that could change how I need to interpret it. It happens all the time, and I learned to ask myself if I am making assumptions based on how I would (prefer to) communicate? It changes your perceptions. ”



### **Emotional Intelligence: Self-Awareness, Resilience and Social Proficiency**

Emotional Intelligence (EQ) encompasses five components: self-awareness, self-regulation (also known as resilience or ‘grit’), motivation, empathy and social proficiency<sup>16</sup>. Purdue undergraduate engineering students, like those at many other selective universities, tend to be high in motivation; but seldom enter college with well-developed emotional intelligence. In reflecting on their GEARE experiences, several participants recounted a story about developing ‘grit’ in a professional context, such as of having learned to adapt productively to “very direct” feedback from supervisors or teammates. In another example, a student learned to regulate his trepidation about learning to “think outside the box”:

“ I have become ok with not necessarily following ‘the path.’ Initially it was hard for me to break away from it. It intimidated me but it was liberating. Follow what you want to do and not what people want you to do.”

Many also indicated a new capacity to take account of co-workers’ feelings and motives, e.g.:

“ Is the “yes” that you got real, are they really understanding you? If not, how do you address that sensitively? ”

“ I am definitely a lot more aware of different perspectives. Thinking more about where the other person is coming from, what their motivations might be.”

<sup>16</sup> Goleman, 2006

## Conclusion: Mentoring Matters

Currently, the Purdue GEARE program is unusual among research universities in offering three semesters of mentoring (by a trained Purdue intercultural coach) that specifically focuses on interpersonal effectiveness across perceived value differences; thus clarifying for each student how to incorporate new or improved interpersonal and intercultural skills into an emerging professional identity. The chart below compares the results of this approach to other benchmark studies on development of undergraduates' intercultural and inclusivity competence.

<b>INTERNATIONALIZED LEARNING INTERVENTION PROVIDED</b>	<b>MEAN IDI GROWTH</b>	<b>SAMPLE SIZE</b>	<b>BENCHMARK STUDY OR REPORT</b>
Un-mentored 'Immersive' Semester Abroad + Language	2.33	1156	Georgetown Consortium Study, Vande Berg et al, 2009
Globalized Engineering + Semester Abroad + Language	6.65	66	Georgia Tech Quality Enhancement Program Report, 2010
3-Semester Mentoring + Semester Abroad + Language	8.08	144	Lou and Bosley, 2012
Purdue GEARE program	13.65	45	Purdue Office of Institutional Research, Assessment & Effectiveness, 2019

In short, this mixed methods inquiry into the GEARE program outcomes supports prior research findings that mentoring matters in the translation of culture-crossing experiences into attitude change as well as the performative professional 'soft-skills' for undergraduates.



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## **ENGR 297 GLOBAL ENGINEERING PRE-DEPARTURE (1 CREDIT)**

Students are exposed to 4 areas of Global Competence

- Increase Awareness of self
- Increase Awareness of others
- Manage emotions in the face of Ambiguity
- Bridge Cultural Gaps

Topics and Activities include

- IDI Assessment including Group debrief and one-hour individual debrief
- Intercultural Communication
- Cultural Dimensions
- Engineering Cultures
- Individual intercultural reflection activities
- Meditation and Mindfulness Exercises
- Mentoring opportunities with returned students
- Development of country specific professional skills (resume, interview, job search)

## **ENGR 397 GLOBAL ENGINEERING EXPERIENCE (1 CREDIT)**

Topics and Activities include

- Goal Setting for Intercultural Learning
- Intercultural Communication
- Stereotypes and Generalizations
- Self- Awareness
- Intercultural Empathy
- Worldview Frameworks
- Exploration of Professional Fields in the Host Country
- Reflection
- Workplace Interactions in the International Location
- Discussions with Intercultural Mentor

## **ENGR 497 GLOBAL ENGINEERING RE-ENTRY (1 CREDIT)**

Topics and Activities include

- IDI Assessment, Group Debrief, and Individual Debriefs
- Intercultural Discussions with Returned Students
- Creation of Logistical Guides
- Teaching of Logistical Workshops
- Mentorship with Students Preparing for Global Experiences
- Professional Skills
- Poster Symposium

# GEARE CURRENT LANGUAGES



SPANISH



GERMAN



FRENCH



CHINESE



JAPANESE



ITALIAN



PORTUGUESE





# GEARE

Global Engineering Alliance  
for Research and Education



Office of Professional Practice



Office of Institutional Research, Assessment and Effectiveness  
Office of the Provost