



Use of Data to Enhance Global Engineering Education

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Abstract

Today's engineering graduates should be prepared to practice engineering in a global context. One of the ways in which students can prepare, we believe, is by studying abroad. However, aside from anecdotal evidence, little data have been published in support of this assumption.

Senior exit survey data were analyzed to determine if there were any differences in educational experiences, co-curricular experiences, satisfaction, and preparedness between those who have or have not studied abroad. Differences between international and domestic students were also examined.

Higher levels of perceived preparedness to work in a global context were found for students who have studied abroad as well as among international students, compared to their counterparts. Differences in specific attributes, including ability to work on a project/product with customers outside the US, work in a team with members from different countries, and work in a globally distributed team, were also found. Students who studied abroad and international students perceived themselves to be better prepared to work globally.

Institutional data were analyzed to identify any areas in which we can make improvements for students or that can demonstrate value of international programs to students. For example, we examined the average deviation from expected number of semesters and years to graduation for these populations of students. We found no significant difference in the time to graduate for students who have or have not studied abroad for a semester. This information is shared with students to help eliminate related concerns that may prevent them from participating in such an experience.

These data are now used to inform current students of the importance and advantages of studying abroad and to address any reservations that they may have. For example, students who studied abroad reported having more full-time job interviews than students who did not study abroad. Senior exit survey data analyses results are being used to inform programming decisions for domestic and international students and the use of limited resources. These data are also used to identify issues that specifically pertain to international students.

Introduction

As we prepare our engineering graduates to enter the global workforce, our industrial advisory boards provide guidance regarding the characteristics our students should have to succeed. One of these characteristics is to be globally engaged¹: "World-Class Engineers understand the worldwide nature of their profession and are sensitive to the speed required to keep pace in geographically and culturally diverse environments."

In addition to the importance of global preparedness given by industry representatives, the College's Global Engineering Education Faculty Planning Committee has also developed a definition of global readiness, with the intention that all of our students are striving to be globally

ready when they graduate from the university. The faculty committee defines global readiness as “1) Having the knowledge and appreciation of the global nature of engineering and related professions, 2) Having the knowledge of the challenges and opportunities associated with contemporary worldwide issues, and 3) Being ready to practice your profession in a global context by being sensitive to and respectful of the differences that affect professional practice throughout the world.”

Given the motivation from both faculty and industry for students to be prepared for the global workforce, we need to examine ways for students to gain this experience. While there are many things that are happening inside the classrooms on campus, one way that we feel prepares students is a study abroad experience. When advising students about these opportunities, we continually hear concerns and hesitations, such as worries that engineering students cannot study abroad, that study abroad will delay their graduation, and that while employers say that there is value in these experiences, they do not translate to results when entering the workforce. Our hope is that by studying survey and institutional data and presenting results to students, we can alleviate some of these concerns that keep them from studying abroad.

In addition, we are seeing a substantial increase in the number of international undergraduate students entering the college. However, we had not previously examined to see if there were any differences in domestic and international students in survey responses or other institutional data. By examining these data sets, we hope to be able to identify areas where we may be able to provide better orientation, advising, and support to international students.

Senior Exit Survey

For many years, the College of Engineering at Penn State has been surveying students to gain feedback and insight into the effectiveness of our programs. The Senior Exit Survey is sent each semester (fall, spring, and summer) to students who indicate their intent to graduate, and asks general college questions as well as department-specific questions. Students receive the link to the web-based survey about two months prior to graduation. They are sent the invitation to complete the survey by e-mail, and are sent several reminders. Survey responses are linked to a students’ institutional data through collection of their Penn State student identification number. This allows us to then compare responses based on gender, nationality, major, campus, and registration status, among other factors. For this particular analysis, it was of interest to look at student’s records to see who had officially studied abroad through the university and compare that population with students who had not studied abroad. Comparisons were also made between domestic and international students.

In Fall 2011, at the recommendation of the College’s Global Engineering Education Faculty Planning Committee, additional questions were added to the Senior Exit Survey pertaining to internationalization. Questions related to a student’s preparedness were also added in Fall 2011. A subset of these questions related to internationalization was also added. The new questions added in Fall 2011 were:

- To what extent do you feel that you have developed your global readiness?
- What international experiences have you had?
 - Travel-Based:
 - Traveled abroad for personal reasons (i.e. a vacation)
 - Studied abroad
 - Worked abroad
 - Campus-Based:
 - Worked on a group project that had one or more international students
 - Interacted with international students in the US
 - Completed one or more foreign language courses during my undergraduate studies
 - Have been involved in an international student group
 - Have an international conversation partner
- How prepared are you to...?
 - Apply engineering skills to your job assignments
 - Design a product, process, or system to meet customer needs
 - Analyze data from experiments
 - *Work on a project/product for customers outside the US*
 - *Work in a team with members from different countries*
 - *Work in a globally distributed team*
 - Work in a team with colleagues from other disciplines (e.g. marketing, law, biology)
 - Develop innovative solutions to problems
 - Make effective oral presentations
 - Write effectively
 - Use project management skills
 - Identify ethical implications of my job assignments and decisions
 - Apply a professional code of ethics in my work
 - Consider sustainability in my projects/products
 - Lead a project team

There are many questions asked on the survey, and not all were of interest for this particular study. In addition to the internationalization questions listed above, other survey questions that were of interest for this analysis included:

- Are you planning to enroll in graduate, technical, or professional school?
- With how many employers did you interview?
- How many full-time job offers did you receive?
- Did you complete an internship (co-op) while at Penn State?
- Did you work abroad during your undergraduate education?
- Did you participate in a faculty-led research group at Penn State or another university?
- How satisfied are you with the Engineering Education (within your major) that you received?
- How satisfied are you with your Penn State education (outside of your major)?

- Please rate your level of satisfaction with each of the following:
 - Interactions with faculty within your major
 - Interactions with other students
 - Ability to assume leadership positions within teams or groups
 - Experiences while working on teams or groups
 - Overall sharing of responsibility of the teams or groups in which you participated

Response Rates

For analysis of Senior Exit Survey results, the graduating classes of 2011-12 (Fall 2011, Spring 2012, and Summer 2012) and 2012-13 (Fall 2012, Spring 2013, and Summer 2013) were combined. Since the questions related to internationalization were added in Fall 2011 and because the populations of international students (6.5%) and students who studied abroad (5.3%) were small compared to the overall population, these groups were combined for analysis. The response rates for this group of students are shown in Table 1.

Table 1. Response Rates for 2011-12 and 2012-13 for the Senior Exit Survey

	Number of Students Graduating 2011-12 and 2012-13	Number of Students Responding to Senior Exit Survey	Percent of Students Responding to Senior Exit Survey
All Students	2997	1749	58.36%
Domestic Students	2801	1648	58.84%
International Students	196	101	51.53%
Students Who Studied Abroad	158	130	82.28%
Students Who Did Not Study Abroad	2839	1619	57.03%

The number and percent of students responding to the survey includes only those students who completed the survey and who received official approval to graduate during the semester that they completed the survey. During that same time frame, an additional 132 students (4.40%) started but did not complete the survey, and another 59 students (1.97%) completed the survey but did not receive approval to graduate. Those students are not included in this analysis. For this population of respondents, 88.8% of students completed the survey in 30 minutes or less.

Students who studied abroad were determined based on students who had a “XS” semester on their transcript. An XS semester refers to a semester during which a student was registered in an official study abroad program through the university. This includes students who studied abroad during fall, spring, and/or summer semesters.

The survey results were examined to determine differences between domestic and international students, or between students who studied abroad and those who did not study abroad. Analysis of Variance (ANOVA) was completed on each of the questions listed above. Significant differences, with $p < 0.05$, are noted in the tables in the following sections, with shading and an asterisk (*) indicating the group with the higher response.

Work-Related Experiences and Post-Graduation Plans

Differences in work-related experiences are examined between groups of students. For questions relating to graduate school and work experiences (internship, co-op, work abroad, and faculty-led research), questions were asked in a Yes/No format. An additional item is added to the analysis which aggregates the responses for participation in internship, co-op, work abroad, and faculty-led research. When asked how many employers a student interviewed with, options were given from zero through nine, with an additional option of “10 or more”. For number of full-time job offers received, students were given the option to reply with zero through four or “5 or more.” ANOVA results for these questions are shown in Table 2.

Table 2. ANOVA Results for Work-Related Experiences and Post-Graduation Plans

Question	Average, Studied Abroad	Average, Did Not Study Abroad	Average, International Students	Average, Domestic Students
Graduate School	25.6%	31.1%	66.0%*	28.5%
Internship	83.8%*	68.2%	55.0%	70.2%*
Co-op	7.7%	8.6%	2.0%	9.0%*
Work Abroad	15.4%*	3.5%	30.3%*	2.9%
Faculty-Led Research	27.7%	26.1%	31.3%	25.9%
Co-op, Internship, Work Abroad, or Faculty-Led Research	93.1%*	79.5%	73.0%	81.0%
With how many employers did you interview?	4.03*	3.45	2.40	3.56*
How many full-time job offers did you receive?	1.75*	1.26	0.79	1.33*

Students who studied abroad participate at a higher rate in internship, work abroad, and the aggregate of work experiences than students who do not study abroad. Students who studied abroad interviewed with more employers and received more full-time job offers than students who did not study abroad. There were no differences in attendance of graduate school or participation in co-op or faculty-led research between these two groups.

International students attend graduate school and work abroad at a higher rate than domestic students. Domestic students participate at a higher rate in internships and co-op opportunities than international students. Domestic students interviewed with more employers and received more full-time job offers than international students. There were no differences in participation in faculty-led research or the aggregate of work experiences between these two groups.

Satisfaction

Differences in satisfaction are examined between groups of students. For each of these questions, response options were Very Dissatisfied, Dissatisfied, Neither Satisfied nor Dissatisfied, Satisfied, or Very Satisfied. For analysis, these were coded as -2, -1, 0, 1, and 2, respectively. ANOVA results for these questions are shown in Table 3.

Table 3. ANOVA Results for Satisfaction Questions

Question	Average, Studied Abroad	Average, Did Not Study Abroad	Average, International Students	Average, Domestic Students
Engineering Education	1.38*	1.14	1.05	1.17
Penn State Education	1.02*	0.81	1.00*	0.81
Interactions with faculty in your major	1.02	0.91	0.91	0.91
Interactions with other students	1.29	1.26	1.08	1.27*
Ability to assume leadership positions	1.35	1.25	0.95	1.28*
Experiences while working on teams/groups	1.02	1.03	1.03	1.03
Overall sharing of responsibility on teams/groups	0.93	0.85	1.04	0.85

Students who studied abroad are more satisfied with their engineering education and their Penn State education than students who did not study abroad. There were no differences between these groups for the other satisfaction items.

International students are more satisfied with their Penn State education than domestic students. Domestic students are more satisfied with their interactions with other students and their ability to assume leadership positions than international students. There were no differences between these groups for the other satisfaction items.

Global Readiness and Participation in International Experiences

Differences in perceptions of global readiness and participation in international experiences are examined between groups of students. When asked to what extent they had developed their global readiness, students were given four options: I have not developed this attribute yet, I have just started developing this attribute, I have developed this attribute fairly well, and I have developed this attribute very well. For analysis, these responses were assigned values of 0, 1, 2, and 3, respectively. For questions relating to participation in international experiences, questions were asked in a Yes/No format. An additional item is included indicating whether a student is an international student. Three additional items were added, aggregating the other responses. One combines all travel-based experiences, one combines all campus-based experiences, and the third indicates any international experience. The aggregate item for travel-based experiences also includes being an international student, but the international student item is not included in the aggregate for any international experience. ANOVA results for these questions are shown in Table 4.

Table 4. ANOVA Results for Global Readiness and Participation in International Experiences

Question	Average, Studied Abroad	Average, Did Not Study Abroad	Average, International Students	Average, Domestic Students
Global Readiness	2.41*	1.62	2.24*	1.65
Personal Travel	62.3%*	43.2%	66.3%*	43.3%
Study Abroad	97.7%*	7.8%	41.6%*	12.8%
Work Abroad	10.0%*	4.6%	28.7%*	3.5%
International Student	8.5%	5.6%	100.0%*	0.0%
Travel-Based International Experience	100.0%*	49.2%	100.0%*	50.1%
Group Project with International Students	40.8%	35.0%	36.6%	35.3%
Interaction with International Students	63.8%*	50.0%	64.4%*	50.2%
Foreign Language Courses	25.4%*	11.4%	17.8%	12.1%
International Student Group	16.2%*	8.1%	46.5%*	6.4%
International Conversation Partner	10.0%	8.3%	24.8%*	7.5%
Campus-Based International Experience	70.0%*	60.3%	70.3%*	60.5%
Any International Experience	100.0%*	75.9%	89.1%*	77.0%

Students who studied abroad have a higher perception of their global readiness than students who did not study abroad. Students who studied abroad also participated in the following international experiences at a higher rate than students who did not study abroad: personal travel, study abroad (self-reported), work abroad, the aggregate of travel-based international experience, interaction with international students, foreign language courses, international student group, the aggregate of campus-based international experience, and the aggregate of any international experience. There is no difference between these two groups in their participation in group projects with international students, or international conversation partners. International students and domestic students participate in official study abroad programs at the same rate.

International students have a higher perception of their global readiness than domestic students. International students also participated in the following international experiences at a higher rate than domestic students: personal travel, study abroad (self-reported), work abroad, the aggregate of travel-based international experience, interaction with international students, international student groups, international conversation partner, the aggregate of campus-based international experience, and the aggregate of any international experience. There is no difference between these two groups in their participation in group projects with international students or foreign language courses.

Preparedness

Differences in perceptions of preparedness are examined between groups of students. For these questions, students were given three options for responses: Not Prepared, Somewhat Prepared, and Very Prepared. For analysis, these items were coded as -1, 0, and 1 respectively. ANOVA results for these questions are shown in Table 5.

Table 5. ANOVA Results for Preparedness Items

Question	Average, Studied Abroad	Average, Did Not Study Abroad	Average, International Students	Average, Domestic Students
Apply Engineering Skills	0.67	0.62	0.43	0.63*
Design Product, Process, or System	0.56	0.50	0.38	0.51*
Analyze Data from Experiments	0.50	0.63*	0.52	0.63*
Work on Project/Product for Customers Outside U.S.	0.36*	0.15	0.43*	0.15
Work in Team with Members from Different Countries	0.61*	0.43	0.68*	0.43
Work in a Globally Distributed Team	0.45*	0.28	0.55*	0.28
Work in a Team with Colleagues from Other Disciplines	0.47	0.48	0.33	0.49*
Develop Innovative Solutions to Problems	0.62	0.55	0.49	0.56
Oral Presentations	0.64	0.60	0.43	0.61*
Write Effectively	0.59	0.58	0.30	0.59*
Project Management	0.66	0.61	0.49	0.62*
Identify Ethical Implications	0.60	0.54	0.42	0.55*
Apply Professional Code of Ethics	0.69	0.64	0.58	0.65
Consider Sustainability	0.59	0.52	0.48	0.52
Lead a Project Team	0.73*	0.60	0.44	0.62*

Students who did not study abroad perceive themselves to be more prepared to analyze data from experiments than students who studied abroad. Students who studied abroad perceive themselves to be more prepared to work on projects/products for customers outside the U.S., work in a team with members from different countries, work in a globally distributed team, and lead a project team than students who did not study abroad. There was no difference between these two groups for the other preparedness items.

International students perceive themselves to be more prepared to work on projects/products for customers outside the U.S., work in a team with members from different countries, and work in a globally distributed team than domestic students. Domestic students perceive themselves to be more prepared to apply engineering skills, design a product, process, or system, analyze data from experiments, work in a team with colleagues from other disciplines, give oral presentations, write effectively, manage projects, identify ethical implications, and lead a project team than international students. There was no difference between these two groups in their perception of their preparedness to develop innovative solutions to problems, apply a professional code of ethics, or consider sustainability.

Time to Graduation

In addition to the Senior Exit Survey, it is also important to study institutional data where possible. This has the benefit of not relying on response rates from students to collect data, so it allows us to gain a complete picture of the data we are examining. One item that we have been

looking at is time to graduation. As many students express concern that studying abroad will delay their graduation date, it is important to examine to see if this is true. Our engineering departments are encouraged to develop semester plans that incorporate a semester of study abroad. One good example of this is Penn State’s Department of Mechanical and Nuclear Engineering². They have developed semester study abroad plans at ten universities around the world, and students can clearly see how they can incorporate a semester abroad and still complete their degree requirements in eight semesters. The hope in doing so is that we can encourage more students to take advantage of semester study abroad programs where they take engineering courses abroad and continue to make progress toward completion of their degree requirements. Since the Mechanical and Nuclear Engineering Department has started this initiative, we have seen a significant increase in the number of students in that department who are pursuing a semester of study abroad.

For this analysis, we only look at students who enter as traditional first-year students (type 01 admit), and do not include students who enter in advanced standing or as transfer students, or those who complete a dual baccalaureate and master’s degree. This helps to maintain consistency in the population that we are studying. For this analysis, we will examine the same population as the senior survey, graduates from the academic years 2011-12 and 2012-13. The number of students who are included in this analysis are shown in Table 6.

Table 6. Number of Graduating Students, Type 01 Admit

Academic Year	2011-12	2012-13	Total
All Students	1271	1362	2633
Domestic Students	1193	1250	2443
International Students	78	112	190
Students Who Studied Abroad	55	65	120
Students Who Did Not Study Abroad	1216	1297	2513
Students Who Studied Abroad for a Semester	25	33	58
Students Who Did Not Study Abroad for a Semester	1246	1329	2575
Students Who Studied Abroad for a Summer	30	33	63
Students Who Did Not Study Abroad for a Summer	1241	1329	2570

As with the survey analysis, because the populations of students who studied abroad (4.6%) and international students (7.2%) are relatively small compared to the overall population, we combine these two years of data for analysis. Some of the numbers for time to graduation will vary greatly if a student takes summer courses. Therefore, in addition to looking at students who study abroad in general, we also look at students who spend a semester abroad separately from students who spend a summer abroad. As before, students who studied abroad were determined based on students who had a “XS” semester on their transcript.

Semesters to Graduation

One way that we can look at the amount of time to graduation is to examine semesters to graduation. Number of semesters to graduation is defined as follows:

$$\text{Semesters to Graduate} = \text{FA semesters} + \text{SP semesters} + \text{SU credits}/15.66$$

Semesters during which a student registers for an internship or co-op are not included. Since the degree programs in the College of Engineering do not all have the same expected number of semesters for program completion, this number needs to be standardized for comparison across the college. Therefore, we look at deviation from expected number of semesters to graduate. This is calculated by subtracting the ‘Semesters to Graduate’ number from the expected number of semesters to graduation for a student’s degree program. For Architectural Engineering, the expected number of semesters to graduation is ten. For all other College of Engineering majors, the expected number of semesters to graduation is eight. The average deviations from expected number of semesters to graduation are shown in Table 7. Significant differences, with $p < 0.05$, are noted in the tables in the following sections, with shading and an asterisk (*) indicating the group with the higher response.

Table 7. Average Deviation from Expected Number of Semesters to Graduation

Population	Deviation from Expected Number of Semesters to Graduation
Domestic Students	0.92
International Students	1.14*
Students Who Studied Abroad	1.42*
Students Who Did Not Study Abroad	0.92
Students Who Studied Abroad for a Semester	0.97
Students Who Did Not Study Abroad for a Semester	0.94
Students Who Studied Abroad for a Summer	1.84*
Students Who Did Not Study Abroad for a Summer	0.92

As expected, since summer credits add to the number of semesters to graduation, students studying abroad in the summer generally took more semesters to graduate than students who did not study abroad in the summer. Students who studied abroad for a semester had no difference in their expected number of semesters to graduation compared to their counterparts who did not spend a semester abroad. On average, international students took more semesters to graduate than domestic students.

In addition to looking at the average deviation from expected number of semesters to graduation, we also examine the percentage of students who graduate within the expected number of semesters. These data are illustrated in Table 8.

Table 8. Percent of Students Graduating Within the Expected Number of Semesters

Population	Percent of Students Graduating Within the Expected Number of Semesters
Domestic Students	30.17%*
International Students	15.26%
Students Who Studied Abroad	13.33%
Students Who Did Not Study Abroad	29.84%*
Students Who Studied Abroad for a Semester	27.59%
Students Who Did Not Study Abroad for a Semester	29.13%
Students Who Studied Abroad for a Summer	0.00%
Students Who Did Not Study Abroad for a Summer	29.81%*

In general, more domestic students graduated within the expected number of semesters than international students. Students who studied abroad for a semester graduate within the expected number of semesters at a similar rate to their counterparts who do not spend a semester abroad. As expected, students who study abroad for a summer do not graduate within the expected number of semesters. Much of this is explained by the percentage of students taking summer classes, since this factors into the number of semesters to graduation. The percentage of students taking classes at least one summer is shown in Table 9.

Table 9. Percent of Students Taking Classes at Least One Summer

Population	Percent of Students Taking Classes at Least One Summer
Domestic Students	59.27%
International Students	86.84%*
Students Who Studied Abroad	80.83%*
Students Who Did Not Study Abroad	60.33%
Students Who Studied Abroad for a Semester	60.34%
Students Who Did Not Study Abroad for a Semester	61.28%
Students Who Studied Abroad for a Summer	100.00%*
Students Who Did Not Study Abroad for a Summer	60.31%

Students who studied abroad for a summer expectedly took summer classes at a higher rate than students who did not study abroad for a summer. Students who studied abroad for a semester took summer classes at a similar rate to students who did not study abroad for a semester. International students took summer classes at a greater rate than domestic students.

Years to Graduation

Semesters to graduation are a good indicator of cost to receive a degree, but this is not necessarily indicative of the amount of time that a student will spend at the university. To see if there were any differences in time to graduation, it was also of interest to examine the amount of

time, measured in years, between the students' date of admission and graduation date, which was defined as follows:

$$\text{Years to Graduate} = \text{Graduation Date} - \text{Admit Date}$$

So that consistency could be maintained across various years of admission and graduation, standard dates were selected. These dates are shown in Table 10.

Table 10. Standard Admission and Graduation Dates Used for Calculations of Years to Graduate

Semester	Admit Date	Graduation Date
Summer	July 1	August 31
Fall	September 1	December 31
Spring	January 1	April 30

The expected number of years to graduation depends on the students' admission date. Students beginning their studies in the Fall semester can expect to graduate in 3.667 years (September 1 – April 30). We assume that students who start in the Summer semester expect that their six week start will not reduce their time spent at the university. These students have an expected number of years to graduate of 3.833 years (July 1 – April 30). Finally, for students starting in the Spring semester, the expected number of years to graduate is 4.0 (January 1 – December 31). Since Architectural Engineering has a different expected number of years to graduate than other majors in the College, the values for students in that major are adjusted accordingly by adding an additional year to what is expected. To determine the deviation from the expected number of years to graduation, the number of years to graduate was subtracted from the expected number of years. The average deviations from expected number of years to graduation are shown in Table 11.

Table 11. Average Deviation from Expected Number of Years to Graduation

Population	Deviation from Expected Number of Years to Graduation
Domestic Students	0.49
International Students	0.42
Students Who Studied Abroad	0.61
Students Who Did Not Study Abroad	0.48
Students Who Studied Abroad for a Semester	0.50
Students Who Did Not Study Abroad for a Semester	0.48
Students Who Studied Abroad for a Summer	0.70
Students Who Did Not Study Abroad for a Summer	0.48

When we adjust the analysis to look at number of years instead of number of semesters to graduation, there is no difference in any of the groups examined in the average deviation from expected number of years to graduation. We also examine the percentage of students who graduate in the expected number of years, shown in Table 12.

Table 12. Percent of Students Graduating Within the Expected Number of Years

Population	Percent of Students Graduating Within the Expected Number of Years
Domestic Students	55.59%
International Students	61.58%
Students Who Studied Abroad	45.83%
Students Who Did Not Study Abroad	56.51%*
Students Who Studied Abroad for a Semester	51.72%
Students Who Did Not Study Abroad for a Semester	56.12%
Students Who Studied Abroad for a Summer	39.68%
Students Who Did Not Study Abroad for a Summer	56.42%*

International students graduate within the expected number of years at a similar rate as domestic students. Students who study abroad for a semester also graduate on time at a similar rate to students who do not spend a semester abroad. Students who studied abroad in the summer graduated on time at a lower rate than students who did not study abroad for a summer.

Use of Data and Conclusions

These data are important to present to students to relieve concerns they may have about studying abroad, particularly for a semester. Many students have concerns that it will delay their graduation by studying abroad for a semester, but these data indicate that, in general, students who study abroad for a semester do not take any longer to graduate than students who do not study abroad for a semester. Since it has been a priority in recent years for the College of Engineering to develop semester plans that include a semester abroad, these data, in combination with the demonstrated eight semester plans, can form a strong demonstration to students that it is possible to study abroad as an engineer.

Students are also concerned that studying abroad will prevent them from participating in work-related experiences. However, these data suggest that students who study abroad participate at a higher rate in internship and work abroad experiences than students who do not study abroad. In addition, students who study abroad have more interviews and receive more full-time job offers. They also indicate that they are more prepared to work in a global context, which are traits that employers look for in our graduates. We can use these data to help alleviate concerns our students and faculty may have about studying abroad, and to encourage more engineering students to take advantage of these opportunities.

Regarding international students, these data can help us to identify areas that need improvement to address in classes. It can also help us find topics of emphasis for college-based international student orientation programs. For example, since international students attend graduate school at a higher rate, we can provide additional programming and assistance to these students during this process. We can provide additional assistance to these students to help them in giving oral presentations and writing effectively. Beginning in Fall 2013, we have added an additional orientation program for first-year international students which focuses on many of the academic issues that are more commonly encountered by international students.

It is important to add questions related to global experiences to data collection instruments to measure the impact of our programs. Particularly with low numbers, it is important to use statistical analysis to identify possible areas for further study. One of the most important lessons is to use data to inform your decisions. While anecdotal evidence from students can be interesting, it is important to have data to support our decision-making in the area of global education, particularly when resources are limited.

In the future, we can conduct additional studies of these data. It would be of interest to examine if there are other factors or interactions of factors that might be influencing these results, and if students who choose to study abroad may exhibit different characteristics at the application stage than those who do not choose to study abroad. Longitudinal studies of these data may indicate if any trends emerge and if our programming efforts make a difference for future populations of students. We can also compare summer and semester study abroad programs, and compare students who participate in travel-based compared to campus-based programs.

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