AC 2012-3428: USING TECHNOLOGY TO TEACH COMMUNICATIONS AND COMMUNICATIONS TO TEACH TECHNOLOGY IN A STUDY-ABROAD LEARNING ENVIRONMENT

Mr. David Bowles, Louisiana State University

David (Boz) Bowles is a Technical Communication Instructor in the Engineering Communication Studio at Louisiana State University. He earned a bachelor's degree in English and a master's of fine arts in creative writing from Virginia Commonwealth University.

Paige Davis, Louisiana State University

Paige Davis has 22 years of experience in the College of Engineering at Louisiana State University. For the past two years, she has directed a study abroad program specifically designed for engineering students. In addition to teaching, she assists with the STEP program. She received her bachelor's degree in engineering technology and master's degree in industrial engineering.

Dr. Warren N. Waggenspack Jr., Louisiana State University

Warren N. Waggenspack, Jr., is currently the Associate Dean for Academic Programs in the College of Engineering and holder of the Ned Adler Professorship in mechanical engineering at Louisiana State University. He obtained both his bachelor's and master's degrees from LSU M.E. and his doctorate from Purdue University's School of Mechanical Engineering. He has been actively engaged in teaching, research, and curricula development since joining the LSU faculty in 1988. As Associate Dean, he has acquired funding from NSF to support the development of several initiatives aimed at improving student retention and graduation rates as well as supporting faculty with development with effective learning and teaching pedagogies.

Dr. Barbara A. Heifferon, Louisiana State University

Using Technology to Teach Communications and Communications to Teach Technology in a Study-Abroad Learning Environment

Abstract:

In the summer of 2010, Louisiana State University (LSU) developed a study-abroad course, *Industrial Engineering 4785: Manufacturing, Technology and Society*, in which students traveled to Germany to develop first-hand understanding and appreciation for manufacturing in a foreign country. Additionally, this study-abroad experience was meant to help expand student worldviews and to promote insights into issues related to engineering on the global stage. The course was certified as Communication-Intensive through the campus-wide Communications across the Curriculum (CxC) program, meaning that, in addition to engineering content, the course focused on communication in two modes: written and visual.

For most engineering students, the financial commitment required for participation hinged upon receiving curricula credit. In 2011, 4 students were unable to receive credit for IE 4785, so another avenue had to be found. At our institution, the natural avenue for opening this opportunity to a broader pool of students was the required course, *ENGL 2000: English Composition,* which focuses on writing in a variety of genres, with an emphasis on research and argumentation. As a result of this challenge, a pilot section of English 2000 was developed. Because of limited travel funds, the English instructor, who shared an appointment with the College of Engineering through the CxC program, remained on campus. The English 2000 section was designed to run concurrently with IE 4785, and was taught online using Moodle[TM], Adobe Connect[TM], GoToMeeting[TM], and Skype[TM].

This paper details the advanced preparation required and the methods used to teach these courses and a description of the global aspects of this study-abroad program, as well as preliminary assessments of the collaborative program.

Introduction:

In *Technically Speaking: Why All Americans Need to Know More about Technology,*[1] the National Academy of Engineering (NAE) has established the importance for engineers' understanding to go beyond technical expertise and to include an understanding of how technology affects society, as well as how society affects the development of technologies. In addition to the importance of technological literacy, the NAE's *Educating the Engineer of 2020, Adapting Engineering Education to the New Century* [2] and the American Society of Civil Engineers' *The Vision for Civil Engineering in 2025* [3] have established the need to better prepare engineers to operate on the global stage. Also, many other publications, most notably the Accreditation Board of Engineering and Technology (ABET), [4,5,6,7] have emphasized the importance of improving communication skills of engineering students. At LSU, all three of these needs have been acknowledged and addressed in the College of Engineering's "Five-Year Strategic Plan: 2010-2015." [8]

With these challenges in mind, our university developed a study-abroad program, Encounter Engineering in Europe (E^3), in which students traveled to Germany in the summer of 2010 to tour factories, plants, and universities, as well as historical sites. Students visited several German cities over five weeks, traveling by train and staying in youth hotels. In the summer of 2011, thirteen students participated in E^3, all of whom were required to enroll in two courses. For the first course, 9 of the students were enrolled in *Industrial Engineering 4785: Manufacturing, Technology, and Society (IE 4785)*, and 4 were enrolled in *English 2000: English Composition (ENGL 2000)*. For the second course, 12 students were enrolled in *German 1101*, and one was enrolled in a Construction Management special-topics course. While the German language course was a vital part of this program, its preparation was conducted separately from the engineering and English courses. This paper will focus on IE 4785 and ENGL 2000, detailing the advanced preparation required and the methods used to teach these courses and a description of the global aspects of this study-abroad program, as well as preliminary assessments of the collaborative program.

Advanced Preparation:

The bulk of the planning took place around the engineering course, IE 4785. The course was certified as a Communication-Intensive (C-I) course through our university's campus-wide Communications across the Curriculum (CxC) program. This program improves student communication skills by integrating communication based assignments in the disciplines. The CxC program recognizes four modes of communication: writing, speaking, visual, and technological communication.[9]

One of the difficulties in preparing students for the global stage is the expense involved in study abroad (see Table 1), particularly for shorter term programs requiring less than a full academic semester or year abroad. For most students, course credit is required to justify the cost of traveling overseas. Because some students' curricula did not allow for them to receive course credit for IE 4785, another means of receiving course credit became necessary. Because of the heavy communications component required for the C-I certification, it made sense to develop a pilot section of ENGL 2000 to run concurrently with IE 4785. Because ENGL 2000 requires writing in a variety of genres with an emphasis on research and argumentation, the outcomes of the English course[10] corresponded well with the C-I goals of the study-abroad IE course. The outcomes required for ENGL 2000 also aligned with the needs of the engineering students, particularly the need for greater communication skills and the synthesis of ideas implied by the call for greater technological literacy.

Table 1: Estimated Cost for E^3

	In-State ($)	Out-of-State ($)
Program Fee	4800.00	4800.00
Tuition	1328.45	4019.45
Airfare	1400.00	1400.00
Spending Money	500.00	500.00
Total	**8,028.00**	**10,719.45**

Additionally, an understanding of technological issues, an ability to overcome challenges of operating in a global environment, and the use of a variety of communication methods were required to complete this pilot English 2000 section. Due to funding limitations, the English instructor, who was also the technical communications co-instructor for the IE 4785, remained on campus. The ENGL 2000 classes were taught using web-conferencing software, Skype[TM], Adobe Connect[TM], and GoToMeeting[TM], as well as our University's course management software, Moodle[TM], and traditional e-mail (see Figure 1).

Figure 1: ENGL 2000 students gather around a single computer
to conduct class via Skype with their instructor.

Composing an Itinerary:

Coordinating a study abroad trip the way E^3 is structured was difficult. Because we did not use a travel provider or coordinate with a foreign university, it was the director's responsibility to plan all details for the trip, including but not limited to: housing, meals, excursions, travel arrangements, and classroom facilities. Scheduling excursions that made the best use of time

always had to be considered. Minimizing travel time and planning for meals along the way was also a necessary challenge (see Figure 2). Once the best day for an excursion was determined, the director had to contact the company and ask for a tour. The day that worked best for E^3 often did not align with the best day for the company. Germany had quite a few national holidays in June that also had to be taken into consideration.

Figure 2: Students spend travel time on the trains completing assignments.

Another concern was the size of the program. In 2010, E^3 had 7 students, and in 2011, it had 13. Adding six more students to factory tours was significant. At times, 13 students and 2 faculty members (IE and German) seemed like too many people. It was a challenge for all the students to be able to see and hear the presentations, especially in some factory settings. It was not feasible to ask a company to provide 2 separate tours in one day, so E^3 has capped the number of students that can participate with the program in its current structure at 13.

Planning Syllabi:

Because the E^3 director had previously taught IE 4785 in Germany in 2010, she was aware of the best opportunities for students to accomplish work, such as airplane and train rides. She was also aware of the places in Germany where internet connectivity was strong and where it was not. Together, she and the English instructor planned the syllabi for both classes to be sure that students in IE 4785 and students in ENGL 2000 would be busy at the same times. Similar assignments were developed for both sections (see Figure 3). IE 4785, like ENGL 2000, involved a research paper. Working with the English professor to meet the C-I requirements of IE 4785, several process drafts, including an outline and an annotated bibliography, were required in both classes and on a similar schedule. For both classes, students were required to

document their observations in a journal as they visited historical sites, plants, and factories, and to publish their thoughts on these excursions to a web log, or blog (https://sites.google.com/a/tigers.lsu.edu/e3-2011/). IE 4785 went further than ENGL 2000, requiring students to publish their visual artifacts in a website. ENGL 2000, however, required more total pages of writing in a greater variety of genres.
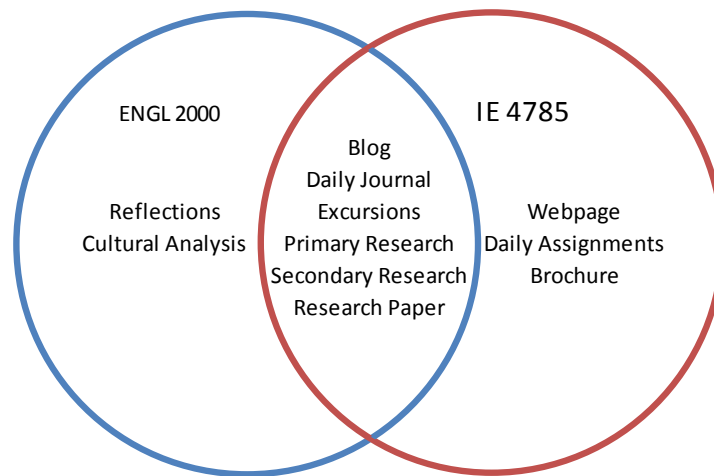

Figure 3: The diagram shows the overlap of the class
assignments given in ENGL 2000 and IE 4785.

Overview of IE 4785:

E[3] offered a unique opportunity to integrate global awareness, technological literacy, and communication skills into a single course (see Figure 4). LSU's College of Engineering didn't offer a course to address all three of these topics, so IE 4785 was designed as a technical elective specifically for study abroad and the E[3] program. The course content focused on the history and development of manufacturing and technology, and its influence on production, society, and environment.
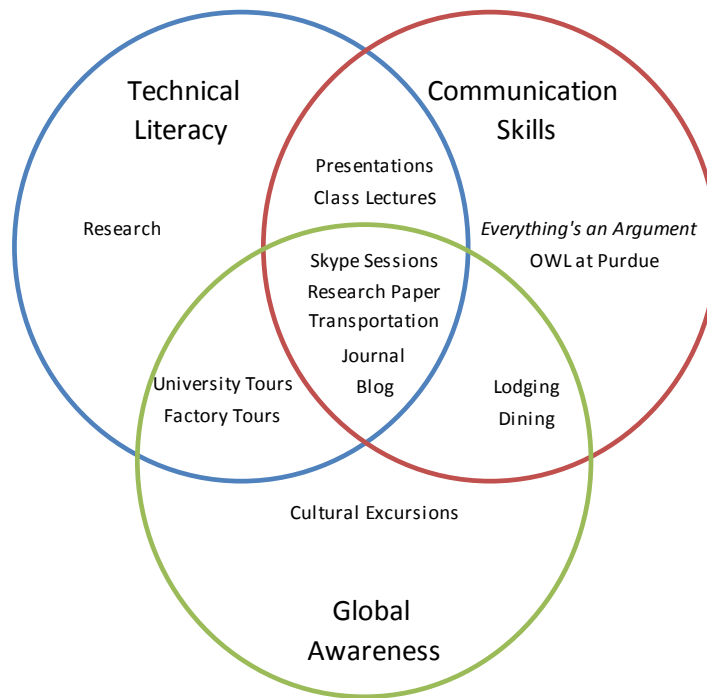
Technical Literacy

Communication Skills

Presentations
Class Lectures

Research

Everything's an Argument
OWL at Purdue

Skype Sessions
Research Paper
Transportation
Journal
Blog

University Tours
Factory Tours

Lodging
Dining

Cultural Excursions

Global Awareness

Figure 4: This diagram depicts the overlap between the program content and the goals for E^3.

Students met in a classroom setting two times per week for lectures and presentations, and all other classes were half- or full-day excursions, visiting factories, museums and universities. The guided factory tours showed students firsthand how manufacturing and technology are applied in a variety of industries, while the tours of museums gave students a historical perspective of the development of technology and its impacts on society. University tours and lectures provided students the opportunity to learn about current research and projects being conducted in Germany. In addition, the tours included hands-on learning, where students not only received demonstrations of machinery and robots, but also were allowed to test some of the equipment in the laboratories. The demonstrations enriched learning for the engineering students because they were not only able to hear and see technology, but they were able to experience it, too. All too often, students recognize technology, but don't quite understand and appreciate it. The E^3 program took students out of the classroom and into the environment where technology is being used, researched and developed. This created an environment rich for learning and thinking critically about the technology we use daily, as well as how it functions (see Figures 5 and 6).

Figure 5: While visiting Magdeburg University, a student tests a camera used to track eye movement.

Figure 6: Students testing a drive simulator at Magdeburg University

C-I Aspects of IE 4785:

As is required of all C-I courses at LSU, students engaged in both formal and informal writing assignments. The informal assignments, which were no-risk, writing-to-learn assignments, took the form of journaling and blogging about each excursion, as well as challenges arising from their immersion into German culture. A typical journal entry might contain notes about breakfast and a train ride, as well as details about experiences on factory tours and visits to historic places. The formal writing, which was assigned and graded, was more traditional. Students researched and wrote a formal essay, following the typical steps that might be assigned in a traditional academic writing class, including an exploratory draft, an annotated bibliography, and a series of revised and edited drafts.

The visual assignments were also divided into formal and informal categories. Videos and photographs were informally viewed by the group when the excursions were discussed at the end of each trip, as well as uploaded to a class blog. The formal assignment was to create a website explaining some aspect(s) of German manufacturing and technology.

Students toured as many sites as possible with cameras and camcorders provided by the College's Engineering Communication Studio,[10] documenting their excursions, with the specific intent of sharing them as a form of primary research. Typically, as shown in Figure 7, roles were assigned (videographer, photographer) before each excursion, so that other students could focus more on what they heard and saw. This division of labor worked well, and kept the focus on documentation of the trip through visual means. The videos were shared on the class blog, but were also used later when the students composed their websites.

Figure 7: Students take videos, pictures, and notes while touring
Staedtler Pencil Company in Nuremberg, Germany.

IE 4785 Assignments:

One of the first assignments upon arriving in Germany was the writing of haiku. Students had just traveled to an unfamiliar continent and were arriving in an unfamiliar country for the first time. The instructors hoped to find a creative way for the students to express some of their feelings and attitudes about their adventure. While engineering students are understandably hesitant to write poetry, the novelty of the assignment served to relax some of the apprehensions of the students and allowed them to share freely thoughts that might not have easily been expressed in a more traditional genre. Immediately, the students bonded through sharing their haiku and began to identify with each other as members of a cohesive group.

All students were required to contribute to the group blog, which was a coordinated effort by the entire group. The students enrolled in IE 4785 were each given four different days to write an individual entry and then required to submit a reflective entry for any day of the trip, as well as submit photos. All entries were submitted to Moodle to be combined in the group blog.

Students were required to keep a journal throughout their trip. These journals were private, in that they were only shared with the instructor. Entries included observations, feelings, interviews, reflections, which were not graded, but were checked for completion.

Formal writing: Four smaller writing assignments were required: a factory analysis, a factory report, a business letter thanking people for interviews, and a tri-fold brochure.

Students wrote technical reports pertaining to a specific company visited by the program. The assignment included an annotated bibliography, point-sentence outlines, research using databases to access refereed journal articles, abstracts, and a bibliography. Topics were selected by the students, and included robots and human interaction, sustainability in the automotive industry, efficiency of public transportation, and passive housing. Students researched a variety of questions:

- How do companies benefit from new safety technologies?
- What injuries are most common when working with a robot?
- Do economically efficient vehicles cost more?
- Will safety be sacrificed in order to achieve environmentally friendly vehicles?
- What percentage of material used in manufacturing is recyclable?

Students also gave brief PowerPoint presentations to their classmates on what they learned about their assigned company.

Students designed webpages that incorporated the research that was conducted while traveling. Research was obtained using technology while studying abroad. However, dependency on technology made research difficult due to weak connectivity and a lack of wireless connections.

After each excursion, students were divided into groups of two or three to compare notes and debrief. A student that took pictures or videos worked with someone that took notes. The two shared their information with one another so that each had a complete set of notes. After several excursions, students then compared different factories with one another. At this point, students paired up again to work on this assignment. These groupings of students varied from assignment to assignment. Some students naturally gravitated toward working with one another, but students were encouraged to switch up and work with different students on each assignment.

Overview of ENGL 2000:

This course is the second in the required sequence of composition courses at our University, and it focuses on academic writing and research. To meet this specific need of these 4 engineering students, a pilot section of ENGL 2000 was developed as a special-topics course to run concurrently with the IE 4785, also focusing on manufacturing and technology in Germany.

Technological Literacy in the Pilot Section of ENGL 2000:

Though the English instructor had not adopted the specific term at the time, "technological literacy" was important to the ENGL 2000 course. First, the assignment topics of the class had to do with studying manufacturing and technology, looking specifically at how they differed in German and American societies. Students' first-hand observations of technology in society provided primary research opportunities for the students, and from these excursions, the students selected topics to examine for an argumentative essay.

In addition to technology as subject matter, the students had to employ technology to complete the course, as mentioned earlier, using web-conferencing software.

ENGL 2000 Assignments:

Students in both ENGL 2000 and IE 4785 were required to maintain a blog, in which they would discuss each excursion, as well as aspects of their cultural immersion. However, the English students branded themselves as a "Band of Misfits" and created a blog within the larger blog. They began to self-identify as a community of writers and researchers—the band of misfits— which worked quite well since their coursework required peer reviews and group work on research.

ENGL 2000 required three major writing assignments: a cultural analysis, which was assigned before students left for Germany and was due upon their arrival; a persuasive argument, which was researched through first-hand observation, interviews, and internet research; and reflective essay, which served as their final exam.

Cultural Analysis: This essay required students to think about the culture to which they were headed before they ever got on the plane. Students from the previous year's trip were asked to

serve as a speakers' bureau, making themselves available for the students to ask questions about what they could expect to find in Germany. Topics ranging from the convenience of the rail system to the hectic travel pace to the meat-heavy breakfast fare were discussed before the students left campus. Students were also encouraged to consult tourism websites and other non-scholarly travel sites to get a sense of what travel through Germany might be like. The students wrote about the challenges they expected to find on their trip in the week before they arrived in Germany and turned those papers in to the instructor at the beginning of their first Skype class.

Persuasive Argument: This essay was aimed at increasing the students' technological literacy as well as their critical thinking and research skills. After traveling to several cities in Germany and visiting a variety of factories, plants, universities, and historical sites, the students selected a topic for their persuasive argument. This paper required a variety of research. The observations, many of which had been documented with students in the IE 4785 class via camera and camcorder, provided primary research for their papers. Students also had to conduct internet searches of our University's databases and indexes from scholarly sources. A variety of topics arose from the combination of factory tours and cultural immersion. One civil engineering student wrote about the possibility of creating a rail system similar to the one in Germany in parts of the U.S. He applied both a technical understanding of how a civil engineer goes about planning a rail system and an understanding of how politics and social views might affect people's views on rail travel. Another paper looked at how the use of robotics in factories might affect employment rates in the area. Yet another looked at how attitudes about the environment might affect choices made concerning renewable energy sources. By connecting their technical knowledge to first-hand cultural experiences, the students gained a greater appreciation for the impact of technology on German culture, as well as a greater appreciation for and understanding of the culture itself.

Reflection: The final exam for the course came in the form of a reflective essay. This essay asked students to remember specific events during their trip and to think about how those events made them feel at the time, consider how those events seemed important to them at the time of their writing, and also consider how they thought those events would change their thinking going forward. Most of the students wrote about the difficulty of time management in the face of such a busy schedule. However, several mentioned cultural challenges, a greater appreciation for the role of technology, and the difficulties involved in communicating across a 6-hour time difference. None of the students mentioned any difficulties in using the web communications software even though several of the methods were new to them. Most of the difficulties in the course arose from the distance between student and teacher.

Student Reflections and Perceptions:

The following results were drawn from the daily blog[11], student reflections, the formal program evaluations that were conducted by Academic Programs Abroad (APA), surveys conducted by the CxC program, as well as an informal analysis that the director conducted on the last day of

class. The APA formal evaluations, CxC surveys, and the informal analyses were anonymous so that students could freely comment on the program, classes, and faculty without concern for being identified.

Global Awareness: One student commented on the informal analysis that the program allowed him to "live like the Germans do" and to "learn to not waste as much." In the APA evaluation, one student mentioned, "The activities submerge you in the culture, which allows you to learn and appreciate the differences. The 'intro days' to the new cities of Nuremberg, Munich, and Berlin were very enjoyable." Another example of the cultural differences was shown on Day 28 from the blog, where one student wrote,

> My time in Germany has shown me a very different approach to religion and daily life compared to what is normally experienced in the United States. I have enjoyed spending enough time here to really see the differences and make a comparison.

Although the students may never actually work in Germany or with Germans in the future, the fact that they understand that each country has its own culture and that it differs from their own will better prepare them for working in the international arena.

Communication Skills: One student stated in the program evaluation, "I enjoyed this course. It took a lot of work and time, but I learned a lot about technical writing. I had to use many forms of communication, which was good practice for the real world."

Technological Literacy: An IE 4785 student wrote on day 23 in the daily blog:

> We left midmorning to head into Munich to visit the Deutsches Museum. We were all eager to see the vast array of technical exhibits that were on display. There was something for everyone; Willis, our electrical engineer, was able to visit the Electrical Power exhibit and see the development of electrical systems over time. For our mechanical engineers, the museum provided everything from Power Machinery exhibits to the massive Aeronautics display. My personal favorite was the Environment and Alternative Power displays which demonstrated a number of factors that I am studying.

An entry from Day 17 of the daily blog read, "We watched the almost completely automated process as BMW vehicles were pieced together by a sea of KUKA robots." Another stated,

> BMW was an awesome experience. In the morning, we went to their research and development center. We were shown how a car is nothing more than a resonate [*sic*] body. Our tour guide set a small music box on the inside of the car and played it to show how much a car body can amplify sound.

One student stated on the informal analysis, "we saw firsthand what our engineering skills can accomplish."

The students' reflective essays served as a vehicle for self-assessment. One topic dominated all four reflective essays in the English section: time management. One student summed up the trip, saying, "In just 5 weeks, I was able to write 3 papers, complete a German introduction, attend over 10 excursions, and live in 3 different cities." He added,

> It would be hard not to enjoy the scenery outside the train window while revising my essay on robotics. These hours were spent improving my paper not because it was class time, but because I knew it was my best use of time.

One of the departmental goals for ENGL 2000 is that students "understand a research assignment as a series of tasks that include: finding, evaluating, analyzing, and synthesizing information from primary and secondary sources."[12] One student, in his reflection, wrote about the multi-tiered drafting process:

> There were many times during the process that I did not know what direction [the instructor] was going, but I stuck with it and wrote. This jumbled bit of words became an idea, that became an outline, and that outline became a paper. I have always dreaded writing research papers, but with the help of this technique, I am no longer fearful.

Another student commented on the use of web-conferencing software to address the difficulty of working in a global environment across multiple time zones, finding it ultimately beneficial, saying,

> I feel that the class through Skype™ was more effective than if I were sitting in a class of ten at LSU, because of the small number of people. [The instructor] was able to give feedback on all of my work when I finished. It was also good for when I had questions I was able to get instantaneous feedback if he was on Skype™, and with the time difference [the instructor] was at work when I was working at night.

A greater understanding of the limits of technology, of the demands of functioning on the global stage, and of rhetorical strategies led these students to improve their abilities to manage time and complete a complex project over a great distance. All four students felt that the course was helpful in these areas.

Qualitative Assessment:

ENGL 2000: For credit for ENGL 2000, students must write for their assessment paper (and final, end-of-semester essay): a researched argument. The English instructor for the study abroad

course taught the same essay and used the same criteria for the four students in the pilot project in which they sought to meet the equivalency for English 2000 while visiting German factories.

The Director of the University Writing Program at LSU assessed the students' final essays, and when matched up with the assessment scores from spring 2011, the students in the pilot study achieved slightly lower results. This may be due to the shorter time frame to write numerous essays when compared with a semester-long course. However, this sample set is small, and with such a small N, generalization and significance are impaired. Furthermore, we are awaiting a more formal departmental assessment, which may prompt changes to the methods used in the pilot, such as adding class meetings before or after the trip.

CxC: Upon completion of the class, the 2011 program participants were given a short survey conducted by CxC to assess the student's perceptions of the communication skills learned in the classes. The results are summarized in Tables 2 and 3.

Table 2: CxC survey for IE 4785

How much did the communication assignments in this course help you to improve your communication skills?				
Very little	A little	Somewhat	More than somewhat	Very much
		1	3	4
How likely are you to use what you learned about communication in this course as you work on future communication projects?				
Very little	A little	Somewhat	More than somewhat	Very much
			4	4

As seen, 7 out of 8 students that took the IE course felt that they improved their communication skills more than somewhat, and all students felt they were more than somewhat likely to use the communication skills they learned in the future.

Table 3: CxC survey for ENGL 2000

How much did the communication assignments in this course help you to improve your communication skills?				
Very little	A little	Somewhat	More than somewhat	Very much
		1		3
How likely are you to use what you learned about communication in this course as you work on future communication projects?				
Very little	A little	Somewhat	More than somewhat	Very much
				4

The results for the English class show that 75% of the students felt the assignments in the course helped improve their communication skills, and 100% of the students believe that they are very likely to use what they learned about communication in the course to work on future communication projects.

Quantitative Assessment:

In 2010, blog topics were self-selected by the students; however, this led to vague treatments of important topics, such as global issues. With the experience gained by the director in 2010, the 2011 blog topics were prompted to address technology, global issues, and communications more specifically. Students were urged to make greater use of the blog as an informal, writing-to-learn tool.

E^3 for 2010 and 2011 maintained a group blog where one or more entries could be included daily. Students enrolled in the IE class were required to write a minimum of five blog entries. In 2011, the four students in the English 2000 class (the "Band of Misfits") added ten entries to the group blog.

As shown in Table 4, the combined daily blogs for each summer were carefully reviewed to assess the number of times students communicated specifically about technology and their experiences using technology for communication. Every reference relating to communication about technology or the use of technology for communication was included in the results. Note: a day's blog could have multiple references that counted for one or both categories tabulated.

Table 4: Comparison of Blog Entries for 2010 and 2011

	Summer 2010	Ratio	Summer 2011	Ratio
Number of Students	7		13	
Blog Entries Reviewed	34		55	
Communication about technology	13	.38	47	1.38
Use of technology for communication	4	.11	13	.38

While students from both summer programs visited approximately the same number of factories, universities, and museums, the results show an increase in the students' mentions in the daily blog. The increase in the comments regarding technology may be partly attributed to the teacher's expectations being more clearly defined in the second year.

It should be noted that the students who went on this trip were self-selected, highly-motivated students. They came from relatively well-to-do families who could afford to send their children

abroad. As such, they were not necessarily representative of the entire College of Engineering student body.

Discussion:

In an attempt to answer the need for increased technological literacy, greater communication skills, and a better understanding of engineering on the global stage, IE 4785 and a pilot section of ENGL 2000 took students on a journey through Germany, visiting manufacturing plants and factories and examining the impact of those technologies on German society. This, of course, forced students to consider how the things they saw in Germany compare to the things they see every day at home. This is important because of the increase of the students' global awareness, as well as their greater depth of understanding about various aspects of technology. The culmination of this understanding is an awareness of potential societal impacts, both positive and negative, that will affect the decisions they will one day make as engineers, but will also have to make simply as functioning members of society.

For the faculty, a greater understanding of how technology can be used in distance-learning will allow for greater involvement from the Engineering Communication Studio in supporting the C-I aspects of IE 4785. The communications instructor now has experience using Skype and similar software to aid students in their composition processes.

Teaching ENGL 2000 concurrently with IE 4785 has also provided a framework for adding new courses into the E^3 program, should another unique need for the inclusion of a course arise. Experience in planning for the overlap of assignments, as well as the planning of work periods to coincide with convenient work situations, like train rides, will make such additions seem far less intimidating for future instructors.

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