

## Developing a Study Abroad Opportunity for Engineering Undergraduates

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### Abstract

The Boston University College of Engineering, in cooperation with the Division of International Programs and the Technical University of Dresden (TUD) in Dresden, Germany, inaugurated a study abroad program in spring 2001 designed specifically for second-semester sophomore engineering undergraduates at Boston University. The program enables engineering undergraduates to incorporate a study abroad experience in their undergraduate degree programs while continuing to make normal progress toward their degrees. Prior exposure or facility with German is not expected before starting the program, but students must participate in an intensive German-language course while in Dresden. The TUD was chosen as a partner in developing this program because Boston University already had a small program and a resident director established at this site. In addition, the TUD had appropriate faculty and laboratory facilities available to teach the requisite science and engineering courses in English. While in Dresden, students take three of four technical courses taught in English by full-time faculty of the TUD, a sociology course also taught in English, and an intensive German language course. The technical courses are based on the same textbooks and syllabi used in Boston and provide comparable laboratory exercises. All courses are Boston University courses, thereby avoiding the transfer credit complications. The semester begins in early February and ends in mid-July. This paper will explain our rationale for choosing this model for an engineering study abroad program, our view of the advantages of this model and the processes undertaken to establish the program. We will report on our experiences with the program to date, and on student outcomes.

### Introduction

In an increasingly global economy in which engineering plays such a fundamental role, it is becoming ever more important for engineers to be knowledgeable about and comfortable with other cultures<sup>1,2</sup>. While it is generally accepted that engineering professionals will require greater understanding of global issues and greater ability to work collaboratively with international colleagues<sup>1</sup>, there are very few study abroad programs available that have been designed especially for engineering students<sup>1</sup>. Even fewer programs allow students to advance in technical coursework while abroad. Thus, at a time of increasing need for international skills—fluency in a foreign language, intercultural understanding and communication, and a global perspective—few engineering students have the opportunity to develop these skills<sup>1,2,3</sup>. The Institute of International Education noted in its annual report, *Open Doors 2001*, that only 3 percent of study

abroad participants are engineering majors<sup>4</sup>.

At the Boston University College of Engineering, we believe wholeheartedly that engineering is increasingly an international profession and that an international experience is an important component of a forward-looking engineering education. Hence, we looked for a way to make such an experience available to our students, while being mindful of the obstacles that have made it difficult for engineering students to study abroad in the past. These obstacles include the rigor and general lack of flexibility in engineering curricula, the lack of fluency in a language other than English seen in most domestic engineering students, the high cost of a college education and the desire of engineering students not to extend their time to degree, and certain ABET accreditation requirements<sup>5</sup>.

The lack of flexibility in engineering curricula creates several problems. There is little time in student schedules for non-technical elective coursework that might be more easily taken in existing study abroad programs. It is also very difficult for engineering students to travel abroad in the junior year, the traditional year for students to study abroad, due to the specificity of degree requirements and the technical nature of the coursework. Additionally, engineers often lack foreign language training, whether from the need to acquire an extensive background in math and science in high school or from disinclination. Furthermore, it is generally very difficult to incorporate such language training into their schedules<sup>3</sup>. Hence, engineering students are often unable to acquire the fluency in a foreign language necessary for participation in more traditional study abroad programs.

### Background and Program Development

The College of Engineering at Boston University enrolls approximately 1,200 undergraduates, in six ABET accredited degree programs: Aerospace Engineering, Biomedical Engineering, Computer Systems Engineering, Electrical Engineering, Manufacturing Engineering, and Mechanical Engineering. Our undergraduate degree programs are designed to share a substantially common curriculum through the end of the sophomore year. The University enjoys a large, long-established International Programs Office with sites in eighteen cities in fourteen countries on six continents. Each international site has a resident director who is employed by Boston University to manage the programs at that site. Depending on the size of the program, additional Boston University and/or international staff provide support to these programs. Boston University was one of the first universities in the United States to send students abroad.

Despite the fact that Boston University has an extensive network of study abroad programs, historically only one or two engineering students a year have participated. In order to participate, engineering students often “tortured” their course schedules to bunch the required social science and humanities coursework into a single semester, and to use study abroad coursework to fulfill these requirements. Alternatively, participation in a study abroad experience often meant extending the length of time required to complete the degree and taking courses while abroad that did not count towards satisfying degree requirements.

Our belief that engineering students urgently need greater global awareness and our understanding of existing impediments to participation led us to consider developing a different

study abroad experience specifically designed for engineering students. A collaboration evolved between the College of Engineering and the Division of International Programs at Boston University, and the Dresden University of Technology in Dresden, Germany. The Dresden University of Technology (TUD) was chosen as a partner because Boston University already had a small language and liberal arts program and a resident director established at this site. In addition, the TUD had faculty available who were willing and able to teach the requisite science and engineering courses in English. All of the participating TUD faculty were familiar with US students and the US education system, having had experience as students or as visiting faculty at US institutions. From this collaboration, a new study abroad program designed specifically for engineering students was inaugurated in spring 2001.

### Program Design

The program is offered in the spring semester and is designed for second-semester sophomores. The second semester of the sophomore year was targeted because this is the last semester in which engineering students at Boston University share a substantially common curriculum. The program enables engineering students to participate in an international experience and develop competence in German language and culture while continuing to make normal progress toward their undergraduate degrees. Students are not required or expected to have prior knowledge of German before starting the program.

The program consists of four technical courses taught in English by full-time faculty of the TUD, an intensive German language course and a sociology course also taught in English by TUD faculty. Students take a total of five, 4-credit courses. All students take German, the sociology course, and three of the four technical courses, depending on major: Electric Circuit Theory, Differential Equations, Modern Physics, and Principles of Biology. These are the same courses students would have taken had they stayed in Boston for the semester. The courses follow the same syllabi, use the same textbooks, and provide comparable laboratory experiences as the Boston-based courses. All are official Boston University courses, and appear directly on student transcripts, thereby circumventing transfer credit issues.

Students arrive in Dresden in early February. After a brief orientation period, students begin their studies with six-weeks of intensive German. During this period, they also begin the sociology course entitled *German Society, Culture, and Technology* that includes guided field trips to research institutions, industrial sites, and museums. This initial six-week study period corresponds with the TUD semester break, which runs through the end of March. Students enjoy a two-week break beginning in mid-March, which they use for extensive travel throughout Europe. With the beginning of the regular TUD semester, students take three of the four technical courses, taught in English by regular TUD faculty. Both the German language course and the sociology course continue throughout the semester in a less intensive format. The semester ends in mid-July. Thus, the entire experience encompasses five and a half months, during which time students earn a total of 20 credits.

## Administrative & Logistical Issues

During the planning stage, faculty from TUD visited BU and met with BU faculty teaching the same courses in Boston. In addition, Dr. Eisenberg, Associate Dean for Undergraduate Programs at the College of Engineering and Dr. DeWinter, Associate Provost for International Education made several visits to TUD to meet with faculty, senior administrators, and the resident director in Dresden.

In addition to the resident director, a resident assistant (RA) is assigned to each group. Thus far, the RA has been a non-engineering graduate student who had previously studied at TUD. The RA is fluent in German and his or her role is to help the new students with the initial settling in process, and to mediate any administrative and social difficulties that students may encounter as the semester goes on.

The cost of participating in the program, including tuition, housing, board, round trip transportation, field trips, and excursions and a modest book allowance, is no more than a student would pay for a semester in Boston. While in Dresden, students are registered for Boston University courses, and the student's full financial aid package is applied to the study abroad semester. Thus, there are no extra financial barriers to student participation.

Each spring someone from Boston University (each of the authors of this paper has taken on this task) travels to Dresden while the students are in residence to check on their welfare, respond to any major issues and concerns, and discuss plans and modifications for the year to come. This annual site visit has proven invaluable to all concerned. TUD faculty have also made periodic visits to Boston University to visit classes and discuss curricula and pedagogy. These exchanges have helped to foster the feeling of transatlantic community between faculty, staff and students.

## Program Outcomes

The Dresden Program is currently in its third year. Twenty-five students have completed the program and another 16 are participating in spring 2003 (two of the 41 participants are from outside Boston University). Two follow-up focus groups have been held for each returning class. The first is in early September, shortly after their return to campus. The second is at the end of January, when students have had a chance to evaluate their reintegration to Boston University. Feedback from these sessions and from the annual visits has been invaluable in helping us to learn about the students' reality in Germany. The opportunity to reflect on their experiences abroad as a group after their return to campus has helped them put their experiences into a more global context, and to develop a more multifaceted appreciation for the global community. In addition, the returning students have become enthusiastic ambassadors for the program, promoting its value and participating in information sessions for students thinking of going to Dresden. They have proven to be a great resource for prospective participants.

The feedback we have received indicates that the program has been very successful. The students have been enthusiastic about their exposure to another culture and have been enlightened by the existence of social policies very different from those in the US. They have traveled avidly at every opportunity. Finally, all report that they have studied hard. They were impressed by the

individual attention they received and commented on their return that they thought they were even better prepared than their peers for junior level coursework. Conversely, the German faculty enjoyed teaching the American students enormously. They particularly enjoyed the degree of classroom interaction and discussion characteristic of the American educational style.

As with most new programs, there has been a learning curve. Grading standards and the initial difficulty with German emerged as the most important issues in the focus groups that we held with the returning students. Course grades are less important in Germany than here, with German students primarily focused on passing exams, not getting grades in individual courses. The German faculty had a hard time understanding the US students' obsession with course grades, and the US students felt that the faculty "did not get it" with regard to their need for high grades. One might argue that this obsession with grades is a particularly unfortunate aspect of modern US academic life. Nonetheless, it was an instance of cultural misunderstanding between the Germany faculty and the US students. Notwithstanding all the student and faculty angst surrounding this issue, examination of pre-participation GPA and grades obtained in the program have shown no significant differences.

Although knowledge of the German language is not required for participation in the program, students expressed the desire to have some exposure to German prior to their departure. In response to this, we will experiment with making admissions decisions in early June rather than November. This will allow accepted students to study German, if they choose, in the summer after their freshmen year or in the first semester of the sophomore year.

#### Future Plans

Our plans for the future include establishing internships in Germany that will be available to program participants in the summer between their junior and senior years. We also plan on establishing one or two additional program sites to provide some measure of choice to engineering students who wish to study abroad. Finally we want to increase the number of non-BU students in the program. Participants to date have included two non-BU students (one from Cornell and one from Washington State University). Boston University has recently signed a contract with Tulane University to enable the Tulane students to participate and talks are underway with several other universities.

All data suggest that this program has been very successful. The program structure enables engineering students to participate in an international experience that includes technical coursework. Students need not have prior knowledge of a foreign language. Additionally, students avoid the frustrations and complexities of arranging for transfer credit. Most importantly, the program allows participants to continue to make uninterrupted progress on their engineering degrees, taking the usual technical coursework required in their respective degree programs in proper sequence.

## References:

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## Biographies:

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JO-ANN MURRAY is the Director of Undergraduate Programs at the College of Engineering. Her office provides support services for engineering undergraduates. She has Masters degrees in both education and social work from Boston University. She has lived and worked abroad and has extensive experience with international students.

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