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Cover Page Footnote

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Sheltered Program at the Technische Universität Braunschweig - Facilitating Studying and Working Abroad: Best Practices

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INTRODUCTION

Many educators in engineering as well as industry representatives agree that the global workplace has already become a reality for engineers.¹ Products are often designed for a global market, and research and development are conducted across the globe by multinational teams. Production is typically outsourced to manufacturers and suppliers worldwide. Thus, engineers today have to be prepared to work in any part of the world, to collaborate in intercultural teams and to communicate in languages other than their own native language. Educators and industry representatives alike see a growing need to include global competence and foreign language instruction into the curricula of American engineering students to enable them to stay competitive and deal with these current global problems that can only be solved by collaborating across borders.² Within the last two decades, a number of American universities and colleges have started to engage in educating such globally competent engineering students, who will not only have to acquire technical skills, but also intercultural and language skills.

The approaches taken by these universities include various types of study abroad, research abroad or internship programs or a combination of these, e.g. the GEARE at Purdue, the MISTI at MIT, or the IEP at URI. Parkinson (2007) has compiled a comprehensive overview of these different attempts to globalize engineering education via exchange programs, dual degree programs, international project work and internships,³ while Sigrid Berka has described seven of the most successful programs abroad and the institutional strategies underlying them.⁴

All of these programs aim at making the engineering graduates "globally competent." But what does this quality involve? According to Grandin/Hedderich (2009), globally competent engineers need to have a sound technical understanding and must be able to work interdisciplinarily, as well as effectively, in global teams and therefore, they must be competent in cross-cultural communication. This latter skill is defined by Grandin/Hedderich (2009) in terms of five dimensions, namely being "1) mobile, open, flexible, tolerant; 2) knowledgeable about other places in the world; 3) culturally aware and attuned to and accepting of difference; 4) multilingual; and 5) perceptive of difference in terms of engineering cultures."⁵ This involves an understanding of how issues such as the sustainability of a product, aesthetics or ethics affect the engineering process in different cultures and how the day-to-day approach to engineering tasks might differ.

Similarly, Parkinson (2009) has collected 13 attributes of globally competent engineers, that coincide largely with the characteristics listed by Grandin/Hedderich but also include attributes such as having "an understanding of the connectedness of the world and the workings of the global economy" and having "had a chance to practice engineering in a global context." In a survey conducted by Parkinson, in which both representatives from industry and academia assessed these characteristics as to their desirability in a globally competent engineer, 12 of the 13 items were rated as 'desirable' or 'highly desirable' by both groups.⁶

In brief, globally competent engineering graduates

- have acquired foreign language skills which enable them to speak at a conversational level and within a technical environment,
- can communicate across cultures and are aware of cultural differences in communication,
- can appreciate and accept other cultures in order to avoid ethnocentrism,
- have some knowledge of other cultures (their history, government, and economy)
- can work effectively in intercultural/multi-cultural teams,

- understand how approaching engineering tasks may differ across cultures.

These goals are not achieved by merely sending undergraduate students abroad for a semester. Educating global engineers requires a major commitment by the engineering students; but it also requires joint efforts by engineering and language departments, as well as close collaboration between the home and the host institution and those involved in organizing the exchange.

The International Engineering Program at the University of Rhode Island

One of the most successful global engineering programs in the US is the IEP (International Engineering Program) run by the University of Rhode Island. The IEP is a five-year dual degree bachelor program, in which students receive both a BA in a foreign language and a BS in an engineering field. In this program, the undergraduate students spend their fourth year abroad, the first half studying at a partner university, the second half doing an internship in a company.

Students taking part in the German IEP spend a semester at the Technische Universität Braunschweig, which belongs to TU 9 (the nine most renowned technical universities in Germany). TU Braunschweig is home to 13,000 students. It comprises six departments, three of which are engineering departments: the Department of Mechanical Engineering, the Department of Electrical Engineering and the Department of Civil Engineering and Architecture. Each department consists of several research institutes, which are headed by a professor and usually consists of several professors and research assistants focusing on a special field of research and teaching in that field. At TU Braunschweig, the Department of Mechanical Engineering comprises 24 research institutes, e.g. the Institute for Automotive Engineering, the Institute for Combustion Engines, the Institute of Fluid Dynamics, the Institute for Chemical and Thermal Process Engineering, the Institute for Aerospace Engineering, the Institute for Flight Guidance, the Institute for Machine Tools and Production Technology etc.

The partnership between URI and the TU Braunschweig has existed for more than 20 years. During this period, the universities have exchanged 530 students at undergraduate and graduate level, of whom 228 URI students and 164 TU Braunschweig students have graduated with dual degrees (this includes incoming/outgoing students at the end of the 2011-12 academic year). As the cooperation was

initiated by language faculty (John Grandin at URI and Peter Nübold at TU Braunschweig), tailoring the language program to the needs of the American students has been a major concern from the start.

The Sheltered Program at the TU Braunschweig

The sheltered program at the University Language Center (ULC) at TU Braunschweig was initiated by the former director, Peter Nübold, who realized the potential of a close cooperation between two language departments and universities. The collaboration culminated in the exchange of teaching staff from the ULC teaching at URI. Experiencing American students at their home university has provided the instructors with valuable insights and experiences that benefit their teaching: they themselves have experienced living and working in a different culture. As a result, they have a profound understanding of the American university system and the expectations of American students.

Based on these experiences, the ULC has developed a sheltered program in cooperation with the IEP that is tailored to the needs of the American undergraduates, thus facilitating their transition from an American to a German university and preparing them for an internship in a German company. In addition, the sheltered program aims to integrate the American engineering undergraduates into a network of German students, an international network and the research community in Braunschweig. An added benefit of the program is that credits earned in the sheltered program at TU Braunschweig can be transferred back to URI.

Pre-sessional International Summer Course at the TUBS

Upon their arrival in Germany at the end of September, the American participants take part in a four-week International Summer Course (ISC) at the University Language Center. This course consists of 24 hours of instruction in German every week, supplemented by a varied program of field trips to cities and cultural sites nearby (Berlin, Hamburg) and major German engineering companies in the area, e.g. Volkswagen Wolfsburg and the steel production company Salzgitter Stahl.

The German courses in the ISC are offered at three different language levels. Thus, after being placed, students are assigned a program that meets their needs. At each level, the German language program is divided into three modules, all of which are taught in German: a general language module which focuses on conversational German, a module on German for

technical purposes, and a cultural studies module that focuses on German history, politics and culture.

Since the ISC is open to all students planning to study at the TU Braunschweig in the following winter semester, the course is attended by international exchange students, thereby offering the American engineering students a multi-cultural learning environment even as they are integrating into their German university.

Sheltered Program during the winter semester

In the following winter semester, the IEP students then take part in the sheltered program, which consists of the following modules:

1. Intercultural Partnership Program,
2. Cultural Studies - Current Affairs,
3. Advanced Technical German,
4. Placement in a university research institute.

IPP (Intercultural Partnership Program)

The objective of the IPP is to create partnerships between American and German students in an intercultural course, in which they explore and discuss the impact of their own culture on their values and attitudes and the way they communicate in general and in various study- and work-related contexts.

The course involves two weekend workshops, a weekly communication course and a partnership in which each American student is assigned a German partner who integrates this student into his/her group of German friends.

In the first weekend workshop, students receive an introduction to intercultural theories.⁷ Through game activities and simulations students become aware of the extent to which their values and attitudes and the ways they interact are determined by their upbringing in a specific culture. In addition, stereotypes that students hold about the foreign culture are explored, which in turn leads to more awareness of their own cultural values, as well as to enhanced intercultural sensitivity when dealing with members of the other culture.

In the weekly communication course taught for the duration of the entire semester, this awareness is needed to understand the more subtle expressions of cultural differences on a linguistic level. Every week different intercultural aspects of communication are discussed, e.g. differences in formal and informal communication at university or in the workplace in the US and in Germany. Special emphasis is put on exploring communicative differences in forms of address, respecting and communicating hierarchy,

being direct, saving face, dealing with the concepts of time and space, etc. Students collaborate on case studies and discuss "critical incidents" they have encountered with Germans in general or German students. The communication class thus provides a sheltered environment in which students can explore their underlying cultural knowledge and enhance their linguistic skills to manage analogous situations successfully in the future. In this class, students are also given further learning materials and have access to an online discussion forum on the internet-based learning management platform Moodle.

The final workshop furthers communicative skills and aims to review the dimensions of cultural differences and discuss further application of the concepts in the students' future engineering workplace.

In past years, both American and German students have repeatedly confirmed the relevance of this intercultural training for their individual education as well as for their professional advancement on the evaluation sheets. The American students felt that the IPP facilitated their integration into student life in Braunschweig and prepared them well for their internship in a German company. For the German students, the IPP provides an opportunity to prepare for studying abroad (possibly in the US or especially at URI) or doing an internship in an English-speaking country.

On the feedback forms, an American participant noted that "the skits about cultural misunderstandings were most useful, because they improve the awareness about how to act when in social settings with people from Germany." Another student commented that IPP was "very valuable for my internship. Role playing made you think." In many cases, the IPP was the first time that American students interacted with German students on a regular basis.

Overall, the American students appreciated the combination of theory and practice and of learning about intercultural theories and standards of a different culture. They benefitted from the more applied role plays in which they could actually practice how to deal with unfamiliar or daunting situations in a sheltered setting within the course and were offered feedback both by a group of German fellow students and by the instructors.

Cultural Studies - current affairs in Germany

The course on cultural studies puts current affairs in Germany into a wider historical, political and economic perspective,⁸ thereby allowing the students

to learn about Germany as a country and its role in the European Union. Starting with issues that are currently being discussed in the media and that may not be easily accessible for foreign students as background knowledge is needed, the course puts these issues into their historical or political context to enable students to understand them in detail. By exploring topics such as demonstrations against nuclear energy in Germany or plans to build a railway station for the 21st century in Stuttgart, Germany, students not only study different German perspectives on these issues, but they also acquire background knowledge on the government, the election system and the political parties in Germany. They study the role activist groups play in the political process, and the extent to which Germany is integrated into the European Union and has to adhere to its policies and regulations.

In this course, the American IEP students are part of an international group of students, with whom they prepare group presentations in multi-cultural teams, thus exploring different perspectives on current German affairs.

Critical thinking skills, in other words, the ability to question and discuss current political, economic and social developments comprehensively are seen as crucial attributes of a university graduate. When the American students go on to their internships in German companies, they will be expected to contribute to office talk about current affairs. This will facilitate their integration into the team and they will be perceived as well-educated students by their German colleagues.

The cultural studies course thus offers the American students the opportunity to explore and discuss current topics and enhance their knowledge about a politically as well as economically important region of the world in a sheltered environment. As related in personal communications, the American participants perceive this course as a valuable source to gather first-hand information on Germany from a German perspective.

Whereas the first two components of the sheltered program, the IPP and the Cultural Studies course, address intercultural communication skills as well as cultural background knowledge, the third component focuses on acquiring the technical language used in engineering and on gaining insight into how engineering tasks are approached at the TU Braunschweig.

Advanced Technical German

The aim of the Advanced Technical German (ATG) course is to enhance the students' knowledge of German for technical purposes. After listening to presentations on current research conducted at institutes at the TU Braunschweig and language work done in class, the students apply their newly-acquired vocabulary by giving presentations in class and writing reports as homework assignments.

In the first few weeks of the semester, the students are introduced to the organizational structure of German universities and the TU Braunschweig in particular. In addition, they practise general study skills, such as listening to lectures and presentations, taking notes in German and summing up their notes orally and in writing. The students thereby acquire the academic language needed to give scientific presentations and write reports.

Research in Teaching English as a Foreign Language (TEFL) has shown that students understand information they listen to more accurately when they have some previous knowledge of the topic.⁹ Therefore, in the following weeks, the group is prepared linguistically for each visit to an engineering research institute by watching videos on a wide range of engineering fields or working on scientific articles. Special emphasis is put on the relevant technical terminology used in that particular field of research, which is possible because the ULC and the engineering departments cooperate. Additional language material, i.e. reading and audio-/audiovisual material, is offered on the internet-based learning management platform, which students can access from home to prepare for the visits to the institutes.

In the institutes, a professor or a member of the research or teaching staff gives the group a short presentation in German on current research conducted in Braunschweig in that field of engineering. After the presentation, the group often has the opportunity to take a tour of the research labs and thereby gains insight into the actual projects of the engineers.

In the following week, the students' task is to write a report on the research presented in the institute and on the tour of the research labs. In the winter semester 2010/2011, six different presentations were offered: five on visits to research institutes (automotive engineering, aerospace engineering, ocean engineering, railway systems, electrical engineering),

and a guest presentation on mechatronics by a URI alumni who works in an engineering company based near Braunschweig. Attending all presentations is mandatory, but students only have to choose three presentations on which to write a report, and a fourth one on which they themselves give a presentation.

Offering presentations on diverse disciplines of engineering has proven to be very beneficial. On the one hand, the students are studying different fields of engineering, e.g. mechanical engineering, ocean engineering, civil engineering or chemical engineering, and thus have the opportunity to choose to write reports on topics closest to their own study or research interest. However, on the other hand, students gain some basic understanding of engineering tasks and methods in other disciplines, thereby acquiring interdisciplinary knowledge. Based on personal interaction with IEP students, we know that the students appreciate this kind of exposure to a variety of engineering fields. They often remarked that although some of the presentations were not from their field, they still found them interesting as they could see how engineering tasks were approached in a different discipline. The students also thought they could apply that knowledge to their own field at some point in their careers.

Overall, students found visiting different institutes of engineering helpful for gaining insight into fields they would not otherwise learn about. On the feedback forms, they noted that they also appreciated the opportunity to practice applying both the technical terminology and the more formal academic language in a sheltered context. The Advanced Technical German course was perceived as an ideal preparation for giving presentations and writing reports in their field of study at the university in Germany or during their internship in a German company.

Placement in a research institute at the TU Braunschweig

All students are offered an institute placement of 120 hours in a research institute of their choice to carry out a student research project within a larger research context. The placements are now either organized by the students themselves in cooperation with the IEP director or organized by the International Office at the TU Braunschweig. In the institute, an advisor, usually a master's or PhD student, is assigned to each student. The advisor sets the student a project, which might be experimental, theoretical or simulative in

nature, and supervises his/her research. At the end of the semester, the student writes a final project report (approx. 10 pages) and gives a presentation, both in German; reports and presentations are formats that have been practiced in some detail in the Advanced Technical German course.

The institute placement is an authentic experiential learning experience which benefits the American students in multiple ways: it breaks up the group of students from URI and integrates the individual student into the research community. This immersion forces them to practice their language skills - both conversational and technical. They also acquire the proficiency and confidence they will need during their internship in a German company. This gives students the opportunity to gain their first work experience in a different cultural context. As Chang, Atkinson, Hirleman (2009) observed, research done abroad in multicultural teams can have a threefold impact: a) a technical impact: students gain access to new research methods and tools, b) a professional impact: students experience different leadership styles and develop skills in project management and teamwork in intercultural teams, and c) a global transcultural impact: students experience working abroad and improve their language skills by immersing in a German team.¹⁰ Some URI engineering departments transfer credits for work done in an institute, thus recognizing the research experience abroad as a valid contribution to the education of a globally competent engineering graduate.

If the students take full advantage of choosing the right institute by contacting researchers close to their own interest ahead of time, the institute placement can be a powerful preparation for the later internship. The IEP director advises students carefully on the choice of institutes or proposes those to the International Office. For example, IEP students have done research at the Institute for Metrology and gone on to a metrology company, Leitz Messtechnik, for their internship; others prepared for an automotive internship at BMW or Volkswagen by doing research at the Institute for Automotive Engineering. Another student who worked in the Institute for Sanitary and Environmental Engineering did an internship in Bayer's Environmental and Solids Processing Department. In all of these cases, the institute placement provided the IEP students with an experiential learning experience, offering work experience and networking opportunities which they will benefit from in their future studies and professional careers.

The feedback from students who took part in the institute placement has been very positive. They felt a sense of achievement when they had finished their student project successfully; furthermore, they had established a network with researchers from TU Braunschweig. They felt that they had made an impact with their student project, often contributing to a research project of much larger scope.

BEST PRACTICES

The following are a set of best practices which have been observed:

1. Interaction with German students is facilitated by offering an intercultural partner program.

Getting to know German students - especially engineering students, who have a very high weekly workload - may not be easy for exchange students if this is not facilitated by a program like IPP. IPP recruits those German students who are willing to commit themselves to taking part in the program for the entire semester and who are interested in getting to know and spending time with American students. In addition, the program offers a distinctly "hands-on" intercultural experience instead of mere intercultural training on a more theoretical level. The participants benefit both from the individual partnership and from social activities offered for the whole group.

2. Cooperation between language faculty and engineering faculty is essential.

As most language instructors who teach technical language classes are not trained engineers, and textbooks on technical language are rare and quickly outdated, it may be difficult for the language instructor to teach the terminology used in current research in various fields of engineering. The cooperation of the engineering faculty is essential in providing the language instructors with insight into topics and methods of research in engineering, which enables them to compile up-to-date teaching and learning materials both for class and for self-study on the internet-based learning management platform. As institute visits to different fields of engineering are offered, the students are exposed to different research methods and tools, thus fostering interdisciplinary thinking.

3. Focus on the connectedness of cultural values and engineering tasks.

Students not only learn about German culture, attitudes and values by participating in the intercultural program and the cultural studies course, they also experience them by interacting with German students, engineers and researchers. Cultural values embedded in German society can be perceived in many different contexts in the sheltered program: e.g. attitudes towards conserving energy and protecting the environment. In the cultural studies class, they discuss why the anti-nuclear energy movement has lately gained momentum, how that has effected stocks of wind energy or solar energy companies, and how the German government subsidizes these forms of power generation. During the institute presentations in the Advanced Technical German class, they learn how German and European regulations impact the development of new engines as well as product design and production methods and materials. All of this information leads students to understand how certain values pervade society, how they are reflected in German or European regulations, and how this provides a framework that substantially influences engineering tasks.

4. Institute placements offer experiential learning experience abroad.

The student projects in the institutes of the TU Braunschweig offer students an additional opportunity to immerse in a group of German researchers, while at the same time experiencing working abroad with all aspects that such an exposure entails: Students practice conversational and technical language in authentic contexts, as the working language in most institutes is still German. Simultaneously, the American exchange students gain access to new research methods and tools, they contribute to ongoing research with their student project, they experience different leadership and teamworking styles, and additionally, they practice professional skills such as writing project reports and giving presentations. They are thus well prepared for the following internship in a German company.

5. Alumni can act as role models and facilitators for achieving global competence.

The integration of American IEP alumni who live and work in the area offer an invaluable benefit to the program: The alumni present the perspective of an American engineer working in a German

company, and provide an insight into his/her research and day-to-day working life. This shows the IEP students that all their efforts are worthwhile. Ideally, the students can establish a network with the alumni to keep in touch when looking for internship placements. In the past, some of these contacts have led to internship opportunities.

6. Exchanging staff enhances the close cooperation between partner universities.

Universities should support and offer their staff incentives to live and work abroad to teach and/or do research at the partner institution for a semester. This will enhance the cooperation of the two institutions as the person involved in organizing and supervising the program will become acquainted with his/her colleagues and the university context of both cultures. Furthermore, having lived and worked abroad will lend credibility to their efforts to teaching students to be globally competent.

7. Facilitate credit transfer.

Close cooperation between the partner universities makes credit transfer easier, which might be a factor when recruiting students for international engineering programs. If students can earn credits during their year abroad, they (and their parents) will be more inclined to pay the tuition and take the challenge of studying abroad.

8. Challenge students to immerse fully in the foreign language, but offer support where needed.

When students are ready to immerse themselves fully in the program, they can make tremendous progress in the language and in their personal and professional development. In this program, all classes - language, cultural studies, engineering - are taught in German, which is a challenge for the students as they have to cope with both the language and the contents. However, the sheltered program offers support at every step of the way and provides the American students with someone to consult on individual, cultural or professional issues: their German partner students, their language instructors or their advisor in the institute. As a result, students are more willing to engage themselves, successfully enroll in engineering subjects, join student engineering clubs and find opportunities to enhance their German experience abroad (e.g. some students joined the Lions Racing team- a student-run project that develops a race car every year).

SUMMARY

Educating engineering students to become globally competent graduates is a challenge that American universities can meet by cooperating with a partner university which is able to integrate and support these students with a language program tailored to their needs. Such a program requires close cooperation with the engineering departments and with the American partner university. This article has demonstrated how the sheltered program at the University Language Center, TU Braunschweig can ease American students into studying and working abroad by providing language support, cultural insights, intercultural experience and an experiential learning experience in research in engineering.

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