EAC Accreditation of an Integrated Bi-directional International Engineering Exchange Program

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Abstract

The Milwaukee School of Engineering (MSOE) has partnered with the Fachhochschule Lübeck (FHL), University of Applied Sciences, Lübeck, Germany to establish a unique bi-directional international student exchange program that is totally integrated into the curricula of each institution. Students from both MSOE and the FHL have a common junior year taught at the FHL and both groups of students complete their senior year at MSOE. All participating students are awarded degrees in Electrical Engineering from both MSOE and the FHL.

The MSOE Electrical Engineering program is in the process of completing the cycle of an EAC accreditation visit. Based on the results, which included a thorough evaluation with a major focus on the exchange program, it is possible to suggest that EC2000 does allow for significant innovation without a negative impact on accreditation, if the accreditation requirements are clearly understood and the process is executed in a diligent manner.

Introduction

The Milwaukee School of Engineering (MSOE) and the Fachhochschule Lübeck (FHL), University of Applied Sciences, Lübeck, Germany jointly developed and implemented an international student exchange program in the discipline of Electrical Engineering (EE). The uniqueness of the program lies in that it is fully integrated into the EE curriculum of both institutions and constitutes a specific degree path at both institutions. If participating students take the associated degree requirements as prescribed, then participation does not delay graduation.

The program was developed in response to the desire to increase student awareness and familiarity of the globalization that is becoming common in the industrialized world. It is highly probable that current engineering graduates will not just directly interact with their counterparts in foreign lands, but that a division of a foreign company will employ our graduates. Hence, knowledge of other cultures and the ability to live and interact in other cultures will increasingly be viewed as an essential skill required for success.
Program Description

During the first two academic years, the students at MSOE and at the FHL pursue the normal course of study at their home institution. This would constitute the “Grundstudium” (Foundation Studies) at the FHL. After completion of the first two years, students participating in the exchange program enter a virtually common curriculum during their junior year taught at the FHL (see Figure 1). For all participants in the international study program the junior year constitutes a joint MSOE/FHL academic year since it is under the auspices of both institutions. As such, it is an off-campus site for MSOE and the academic content is determined and reviewed jointly by MSOE and the FHL.

Both groups of students complete their senior year at MSOE, although not in a common set of courses. Since the junior year at the FHL does not equate to the identical set of courses as normally taken at MSOE, the MSOE students complete their remaining academic requirements, consisting of a mix of junior and senior year courses. The FHL students take a set of prescribed courses at MSOE that complete their FHL academic requirements. The FHL students also complete their FHL Diplom Arbeit requirement (Diploma Design Project) while at MSOE. This is a major design experience and is normally performed in an industrial setting.

All participating students are awarded degrees from both MSOE and the FHL upon the successful completion of all academic requirements, the BSEE degree from MSOE and the Diplom Ingenieur (FH) from the FHL. Anecdotal comments suggest that for MSOE students the experience of living abroad is of greater importance than the second degree from the FHL. On the other hand, the FHL students generally have already had extensive international experiences before coming to MSOE. For them the MSOE degree opens significant career opportunities for employment and possible graduate school studies in the US.

MSOE students are not required to have any prior knowledge of German in order to participate in the exchange program. All courses taken at the FHL are taught in English, except for their German language class. This is a key program component since typically few US engineering students have sufficient language skills in German to survive being thrown into an instructional setting of a foreign tongue. A second significant component of the program is that it provides the best aspects of an immersion type program while in the company of fellow student from one’s home institution. The students generally quickly develop a strong comfort level of living and studying abroad.

The English language skills of the FHL students are quite good upon coming to MSOE and are demonstrated in their success in the various classes, including 3 required course in the humanities and social sciences. Further, the German academic program places a strong emphasis on the Diplom Arbeit project, which forms a major component of the FHL GPA. The outcomes for the project for FHL students studying at MSOE have been outstanding, as judged both by the MSOE academic advisors and the companies sponsoring the projects.
The program has been in existence since 1994 with the number of participants being typically 4-8 MSOE students and 5-8 FHL students each year. Up to this point, all participants have completed the program successfully.

The Institutions

MSOE is a small private university in Milwaukee, Wisconsin, with a primary focus on engineering, business, and medically related programs. The Fachhochschule Lübeck is a government supported University of Applied Sciences in the Bundesrepublik Deutschland with a primary focus on applied engineering, business, and the natural sciences. Both institutions are primarily teaching institutions and because of their respective traditions are an extremely good match for each other.

The development and implementation of the exchange program required a strong commitment and flexibility from both institutions to make it work. The FHL, in particular, was first required by law to gain permission from the relevant German government academic accrediting agencies to implement the exchange program and then the FHL converted the agreed upon classes into English taught courses. Significant issues had to be addressed regarding grade conversion between the German and US systems, transcript entries, mapping of the curriculum between institutions of courses taken, and assessment processes.

German Educational System

Germany has an educational system governed largely by rules and procedures determined both at the national and state level. The rules and regulations are determined by a variety of constituencies, including industry, professional societies, conferences of educational leaders, and the departments of education. The impact of the governance of the system is such that the educational path by which a prospective student arrives at the institution of higher learning assures the entrance qualifications of the student to that institution. Hence, entrance qualifications are framed in terms of diplomas and/or certificates from the appropriate preparatory institutions. Since all state financed institutions must uniformly meet the same guidelines and are bound by the same regulations, following the proper academic path provides the entrance requirement for the Fachhochschule Lübeck (and, likewise, other German academic institutions). Hence:

Successfully following a proper and prescribed educational path provides the assurance that the students are adequately prepared to enter the next level of education.

In keeping with the more centralized German educational system, programs of study must first undergo close scrutiny to assure that guidelines and regulations are met, before the program of study can be offered to students. This constitutes an accreditation process similar to EC2000.
After official approval, subsequent periodic evaluations focus on whether the program of study is adhering to the mutually agreed upon educational goals and the program’s effectiveness. The guidelines and regulations are established based on input from interested constituencies. Procedurally, USA universities follow an opposite process, first establish a curriculum and then, at the appropriate time, seek accreditation.

The joint MSOE/FHL International Study Program, like any new curriculum or subsequent curriculum changes, required and received government approval. Furthermore, at regular intervals the program is reviewed and reevaluated. The last evaluation of the FHL Electrical Engineering Department, including the international program, took place in 1997.

**Program Accreditation**

It is the responsibility of a program seeking EAC accreditation to demonstrate clearly that the program meets all the criteria of EC2000 (now called the Engineering Criteria). At the heart of the criteria is that the program has to define and publish detailed educational objectives and then demonstrate that graduates meet those objectives, including the outcomes (a)-(k). Additional major components of the criteria require involvement of the program’s constituencies and continuous evaluation and improvement. Further, every degree path in the program must meet EC2000 for the program to become accredited. The EE program at MSOE has the normal degree path and the paths taken by the participants in the international exchange program.

The participants in the international exchange program form two separate groups, the MSOE students and the FHL students, since each group has a different degree path. Both groups of students satisfied all minimum ABET requirements of topic coverage and met the objectives and outcomes of the MSOE EE Program. The essentials of the topic coverage are shown in Figures 2 and 3. The tabulations compare the curriculum of the international degree paths to both the regular MSOE path and the EC2000 requirements.

FHL students satisfy MSOE graduation requirements by successfully fulfilling all aspect of a prescribed academic path that includes the FHL “Grundstudium” (Foundation Studies - 1st two years), the MSOE/FHL junior year at the FHL, and the senior year at MSOE, including the Diploma Design Project. The Diploma Design Project is the final stage of the German academic process and has as its purpose the intent to bring the accumulated knowledge of the students to bear on an engineering design problem of considerable difficulty normally encountered in the practice of engineering. Hence, the scope of the Diploma Design Project requires the student to exercise and engage in a considerable number of the EE program educational objectives. Hence, the FHL students will have met all EE program academic goals and objectives in a manner different but equivalent to the traditional path followed by our own MSOE students.

The MSOE students participating in the international exchange program satisfy MSOE graduation requirements in almost the same manner as regular non-participating MSOE students. The
students meet the standard curriculum requirements, except for two course substitutions. And their experience of living abroad strongly enhances many of the EE program’s educational outcomes such as “knowledge of contemporary issues and a greater global awareness.”

Further Assessment Issues

The assessment of the MSOE/FHL International Study Program occurs at the following levels:

1. German Government (federal and state) assessment when the program is initially proposed and granted permission to be offered per guidelines set by various constituent bodies, including ZVEI, VDE (equivalent of the IEEE), Fachbereichstag Elektrotechnik, and Hochschulrektorenkonferenz.

2. Each institution (MSOE and the FHL) performs its individual assessment process of its educational components involving all international students.

3. MSOE and the FHL jointly assessment the student outcomes for the joint MSOE/FHL junior year.

The EC2000 assessment process of the EE program educational objectives and of the student outcomes extends, by necessity, deep into the FHL curriculum for the students whose studies begin at the FHL. Since the FHL was required to go through the process of receiving permission to offer the international course of study, the FHL was very familiar with the need for documentation and student outcomes.

A major assessment component for both groups of participants, MSOE and FHL, is their academic performance during the senior year at MSOE. The MSOE students return from their junior year in Lübeck with greatly improved technical skills and with a global awareness and knowledge that would not be possible to attain by following the traditional curriculum track at MSOE. The FHL students readily demonstrate their strong technical and non-technical abilities during their Diploma Design Project and senior year academic course work.

Conclusions

The Milwaukee School of Engineering and the Fachhochschule Lübeck have developed and implemented a student exchange program that is integrated into the normal curricula of both institutions. The main practical results of the program is that the MSOE students gain a broad and unique international understanding, in addition to the academic advancement of their junior year abroad, and the FHL students gain an academic degree that allows them ready employment in US industry and opportunity for entry into US graduate programs.

One of the purposes of EC2000 had been to allow greater flexibility and innovation than was, perhaps, possible under the traditional criteria. A key conclusion of our experience is that considerable innovation is possible when an EAC EC2000 evaluation visit is carried out in a thoughtful and conscientious manner, with a focus on what EC2000 does and does not specify.
Biographical Information

OWE PETERSEN
Dr. Petersen is Professor and Program Director of Electrical Engineering at the Milwaukee Schoo
l of Engineering (MSOE). He is a former Member of the Technical Staff at AT&T Bell Labs. He received the BSEE degree from the University of Wisconsin in 1963 and the MSEE and Ph.D. degrees from the University of Pennsylvania in 1965 and 1971, respectively. He is a Senior Member of the IEEE and an ABET EAC program evaluator.

JOHN GASSERT
Dr. Gassert is Professor and Associate Chair of Electrical Engineering and Computer Science at the Milwaukee School of Engineering. He received both his Ph.D. in Biomedical Engineering in 1995 and his MS degree in Electrical Engineering in 1974 from Marquette University. He also spent 17 years in industry in positions as a design engineer, a clinical engineer and as a consultant. He is a Senior Member of the IEEE and an ABET EAC program evaluator.

STEFAN BARTELS
Dr. Bartels is Professor and Department Chair of Electrical Engineering at the Fachhochschule Lübeck. He joined the FHL in 1993 after R&D positions with Daimler Benz (Design of Radar Systems) and Bosch/Blaupunkt (Chip-Design for RF- Receivers). He received the Dipl.-Ing. (U) and Ph.D degrees from the University of Hannover in 1984 and 1991, respectively.

HOLGER DAHMS
Dr. Dahms is Professor of Electrical Engineering at the Fachhochschule Lübeck since 1991. He received the Dipl.-Ing (U) degree from the Technical University of Darmstadt and the Ph.D. degree from the University of Dortmund. He has held research positions with AEG-Telefunken (control structures of switching systems) and Nixdorf (teletraffic problems in modern PABX systems and communications).

JENS THIEDKE
Herr Thiedke is a laboratory engineer at the Fachhochschule Lübeck (FHL), since 1994. He graduated from the FHL in 1994 with the degree of Dipl.-Ing. (FH). He provides the laboratory support for the international student exchange program and is the central point of contact for the USA students at the FHL.
International Student Exchange Program
Degree Path

MILWAUKEE SCHOOL OF ENGINEERING

Fresh Year

Sophomore Year

Senior Year
Including Senior Design Project

FACH HOCHSCHULE LÜBECK
University of Applied Sciences

MSOE

FHL

Quarter

Semester

1.

2.

3.

4.

5.

Fresh Year

Sophomore Year

Common Junior Year

Internship

Grundstudium

Grundstudium

Internship

BSEE

Dipl.-Ing. (FH)

Figure 1
### MSOE/FHL International Study Program Curriculum Track

**Fachhochschule Lübeck Student Curriculum Path Mapped Into Normal MSOE EE Curriculum Requirements**

<table>
<thead>
<tr>
<th>Academic Content When Taken</th>
<th>Math/Science</th>
<th>Engineering Topics</th>
<th>General Studies</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-University*</td>
<td>8+</td>
<td>4</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Grundstudium (First 2 years)</td>
<td>45</td>
<td>46</td>
<td>10.5</td>
<td>3</td>
</tr>
<tr>
<td>FHL Junior Year</td>
<td>0</td>
<td>49</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>MSOE Senior Year</td>
<td>3</td>
<td>25</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Additional FHL Courses Not Covered at MSOE</td>
<td>4.5</td>
<td>6</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>Total – FHL Students Including Pre-University</td>
<td>60.5+</td>
<td>130</td>
<td>39</td>
<td>10</td>
</tr>
<tr>
<td>Total – FHL Students Without Pre-University</td>
<td>52.5</td>
<td>126</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>Total – Normal MSOE Curriculum Track</td>
<td>53</td>
<td>98</td>
<td>39</td>
<td>13</td>
</tr>
<tr>
<td>ABET Minimum</td>
<td>48</td>
<td>72</td>
<td>Consistent With Program</td>
<td>0</td>
</tr>
</tbody>
</table>

**Summary:** The academic path followed by the FHL students satisfies the minimum ABET requirements of topic coverage and meets the goals and objectives of the MSOE EE Program.

**Figure 2**

*Pre-University: A small part of the initial MSOE curriculum track is satisfied by German pre-university academics. This is of importance in mapping the FHL student’s total academic background into the MSOE curriculum. Example - a minimum of 2 years of Physics and Chemistry, and foreign language requirements are taken before entry into the FHL.*
## MSOE/FHL International Study Program Curriculum Track

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<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSOE Freshman/Sophomore Year</td>
<td>39</td>
<td>35</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>FHL Junior Year</td>
<td>3</td>
<td>40</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>MSOE Senior Year</td>
<td>11</td>
<td>32</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Total – MSOE Students</td>
<td>53</td>
<td>107</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>Total – Normal MSOE Curriculum Track</td>
<td>53</td>
<td>98</td>
<td>39</td>
<td>13</td>
</tr>
<tr>
<td>ABET Minimum</td>
<td>48</td>
<td>72</td>
<td>Consistent With Program</td>
<td>0</td>
</tr>
</tbody>
</table>

**Summary:** The academic path followed by the MSOE students has the same credit count as the normal curriculum track, satisfies the minimum ABET requirements of topic coverage, and meets the goals and objectives of the MSOE EE Program.

**Figure 3**