

A Model Bi-Directional Integrated International Engineering Exchange Program: Functional Details for Success

**Owe Petersen, John Gassert / Stefan Bartels, Holger Dahms, Jens Thiedke
Milwaukee School of Engineering, USA / Fachhochschule Lübeck, German**

Abstract

This paper describes the essential functional issues addressed, and the methods and decisions used to resolve those issues, to successfully implement a unique bi-directional international student exchange program in Electrical Engineering between the Milwaukee School of Engineering (MSOE) and the Fachhochschule Lübeck (FHL), University of Applied Sciences.

Prior papers and presentations provided the general outlines of the international student exchange program or primarily focused on details related to the ABET accreditation process.¹⁻⁴ The latter is a crucial issue since every degree path must meet all EC2000 accreditation criteria. Over 100 students have participated in the program since its inception in 1994. All but one student successfully completed all requirements of the exchange program and received degrees from both MSOE and the FHL.

Introduction

Many universities offer opportunities to study in a foreign country. The organization of the student exchange programs range from a university serving as a gathering point and providing an umbrella program for students from many institutions to universities establishing a presence in a foreign country and exporting their own faculty to teach courses. Other institutions have a coordinated program of study that includes formal consideration of how the study abroad experience at a foreign university advances the student's progress towards a degree.

The Milwaukee School of Engineering (MSOE) and the Fachhochschule Lübeck (FHL), University of Applied Sciences, Lübeck, Germany jointly developed and implemented a unique international student exchange program in the discipline of Electrical Engineering (EE). The uniqueness of the program lies in the fact that it is fully integrated into the EE curriculum of both institutions and constitutes a specific degree path at both institutions. Graduation is not delayed for students who participate and successfully complete the prescribed academic requirements.

The international student exchange program was developed and completely implemented in approximately 1-year. Many issues had to be resolved, some anticipated and others initially unforeseen. The successful implementation of an international student exchange program clearly hinges on the details – “The devil is in the details.” One normally thinks in terms of simply having students take courses and transferring them to the home institution. But the curricula of both institutions must be sufficiently similar in order to allow a coordination of courses and structure that will achieve the educational objectives of both institutions, i.e., basic decisions had to be made regarding how the exchange curriculum would fit into the home curriculum.

Following a brief description of the exchange program and the academic institutions involved, this paper presents the resolutions to the major issues that had to be addressed in the development of the program.

MSOE/FHL International Study 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) for the FHL. After completion of the first two years, students participating in the exchange program enter a virtually common curriculum during their junior year that is taught at the FHL. For all participants in the international study program the junior year constitutes a joint MSOE/FHL academic year with the academic content determined, reviewed, and assessed jointly by both institutions.

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 MSOE 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 the BSEE degree from MSOE and the Diplom Ingenieur (FH) from the FHL upon the successful completion of all academic requirements.

The Institutions

MSOE is a 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 teaching institutions with similar missions.

Issues and Resolutions

1. Issue: Student Profile

Resolution: Engineering students typically are determined to achieve constant academic progress towards graduation. They are less inclined to explore the world at large for the sake of the experience that might be provided. They are reasonably settled on their immediate career path and any exploration should at least provide useful result. Hence, in order to be successful the program had to provide very specific benefits in order to attract a sufficient number of students. Therefore, the program was designed to insure academic progress commensurate with that achieved by the student who chose not to participate.

2. **Issue:** Length of Stay Abroad:

Resolution: MSOE is on a quarter system while the FHL is on a semester system. Furthermore, the German academic year is shifted in time with respect to the standard USA academic year, starting in late September and finishing in late June or early July. From a practical standpoint, this mandated that the exchange program constitute an entire academic year. Otherwise, the credited academic progress would have been insufficient to avoid lengthening the time to graduation.

3. **Issue:** Tuition Moneys

Resolution: MSOE is a private university and the FHL is a state university of the Bundesrepublik Deutschland. As such, each has a very different tuition rate and accountability requirements for financial decisions. Based on the expectations that over the long term some semblance of parity would exist in the number of students going in each direction, the fundamental decision was made that all students would pay their normal tuition to their home institutions during their participation in the international exchange program. There would be no exchange of moneys between the institutions. The expectation of parity has been realized to a reasonable extent, but only over the long term. Early in the program the number of program participants was skewed in favor of the FHL. That has reversed for the last couple of years and is currently strongly in favor of MSOE.

4. **Issue:** Language of Instruction

Resolution: An essential decision was to have English be the language of instruction in all classes MSOE students take at the FHL. The only exception was the German language class. MSOE students are not required to have any prior knowledge of German in order to participate in the exchange program. This is a key component since it is a rare event to find a significant number of interested Electrical Engineering students who are sufficiently proficient in German to be able to survive in a German classroom?

The FHL students coming to the US have significant English language skills, as is typical of many European students. Further, the common junior year at the FHL, together with the MSOE students, allows considerable practice in English for the FHL students. Hence, the English language skills of the FHL students are quite good upon coming to MSOE. This has been demonstrated at MSOE by their success in the various classes, including three required courses in the humanities and social sciences.

The issue of language also strongly impacts the faculty asked to teach the English language courses at the FHL. This required a major commitment by the FHL faculty members and has been very successful.

5. **Issue:** Curriculum Development

Resolution: The courses that comprise the curriculum taken abroad had to meet the criteria of being fully integrable into the home curriculum. This was necessary to assure the same progress towards graduation had the student not participated in the program. Also, the curriculum content had to meet the appropriate educational objectives of both electrical engineering departments. For the FHL junior year the resulting courses were a

mix of junior and senior courses when compared to the regular MSOE curriculum. The program took advantage of the strengths the FHL has in the areas of high frequency topics, communications, and controls, rather than make an attempt to recreate the MSOE junior year. A similar situation existed for the FHL students while at MSOE, except course choices were encouraged for their humanities and social science electives.

Since English is the language of instruction at the FHL, the prescribed courses of the junior year are fixed. It is clearly not practical to convert a large number of courses into English for what would most likely be a minimal class size.

6. **Issue:** MSOE Transcripts Entry of Courses Taken at the FHL

Resolution: Courses of the junior year at the FHL are considered to be MSOE courses, since they were jointly developed and are jointly reviewed and assessed. However, it is not possible to simply enter the FHL courses directly on the MSOE transcript. The semester long FHL courses simply do not match MSOE courses in their content on a course-by-course basis. It is the totality of courses that comprises the equivalent academic load at MSOE and it is the yearlong educational outcomes that provide the curriculum match. Hence, the courses are listed on the MSOE transcript as equivalency courses, not transfer courses.

The academic course work of the Grundstudium (first two years) of the FHL students is counted as transfer credit.

7. **Issue:** Transferring of Grades

Resolution: Grades for the equivalency credits of the junior year are included in a student's MSOE transcript, but transfer course grades (Grundstudium) are not included. The transfer of grades was greatly complicated by major differences between the German grading system and the MSOE system. The German system has different and more outcome possibilities, consisting of grades of 1.0, 1.3, 1.7, 2.0, 2.3, 2.7, 3.0, 3.3, 3.7, 4.0, and 5.0, where 1.0 is the highest grade and a 5.0 is a failure. MSOE follows a traditional USA system that assigns grades of A, AB, B, BC, C, CD, D, and F. Further complications encountered consisted of: a) needing to align what constitutes "average" performance at both institutions, b) not all FHL courses result in a numerical grade, and c) the FHL testing of student performance distinguishes between what constitutes an exam versus a test. A greater weight is assigned to an exam. All of these issues were dealt with by devising a grade conversion process that is fair to students of both institutions.

The FHL course work, labeled as equivalency credits, is entered on the MSOE transcript as a single block of credits.

8. **Issue:** Preparation and Continued Support of Students

Resolution: The MSOE students attend information sessions and an informal class to familiarize them with the customs and social mores of Germany and traveling throughout Europe. The FHL students are invariably inveterate travelers and have little need of being coached before arriving at MSOE. However, both groups of students upon their arrival abroad receive continuous care and attention. Emails from "home" also arrive at a steady

rate as the academic year progresses. The exchange program is very careful not to give a sense of having abandoned the students once they leave home turf.

Regardless of how the program is organized, we believe the people issue is always critical, especially for the MSOE students. They typically have not traveled widely. Hence, it is important to have someone with whom the students can interact on a weekly basis while abroad, so that trust has been built for those instants when problems occur.

9. **Issue:** Administrative Support:

Resolution: 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 convert the agreed upon classes into English taught courses.

The strong relationship between the faculty and administration of the institutions is a key aspect of the program. Usually, multiple personal contacts occur yearly, including faculty exchanges for short courses or lectures.

10. **Issue:** Diplom Arbeit

Resolution: After completion of all academic courses, the FHL requires its students to successfully complete a major engineering design project (Diplom Arbeit), normally in an industrial setting. Since the FHL students complete their senior year at MSOE, the EE program assumed the responsibility of finding suitable projects in regional industry.

11. **Issue:** Benefits of Participation

Resolution: Anecdotal evidence suggests 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 USA. A significant number of FHL students stay in the USA for several years, working for an American company, and then return home.

12. **Issue:** ABET Accreditation of the MSOE EE Program

Resolution: It was recognized that this potentially could be the deciding factor of whether the international exchange program would survive. However, the new EC2000 Criteria allow, and even encourage, innovation in engineering education. Our experience suggests that, if properly executed, innovation is indeed quite possible.

Conclusion

The Milwaukee School of Engineering and the Fachhochschule Lübeck have developed and implemented an international student exchange program that is fully integrated into the standard curricula of both institutions. The program allows the opportunity for participating students significant cultural immersion, while in the company of fellow students from home. A total of 106

students have participated in the program, with all but one MSOE student completing all program requirements.

The resolution of the listed issues clearly shows that the central factor of a successful exchange program is not an elegantly written agreement, but rather rests on the strength of the personal relationships forged between the faculty and administration of the two institutions.

Bibliography

1. Owe Petersen, et al, *ABET Accreditation of an International US-German Degree Path*, ASEE/SEFI/TUB Conference, Berlin, September 2002
2. Stefan Bartels, et al, *Comparison of the US-German Accreditation Process: A Case Study*, ASEE/SEFI/TUB Conference, Berlin, September 2002
3. Owe Petersen, et al, *ABET Accreditation of an International US-German Degree Path*, ASEE Conference, Montreal, June 2002
4. Owe Petersen, et al, *A Model Bi-directional Integrated International Exchange Program for Engineering or Business*, NCA/Higher Learning Commission Conference, Chicago, March 2002

Biographical Information

OWE PETERSEN

Dr. Petersen is Professor and Program Director of Electrical Engineering at the Milwaukee School of Engineering (MSOE). He is a former Member of 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 the MSBE and Ph.D. degrees in 1974 and 1995, respectively, in Biomedical Engineering 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 MSOE students at the FHL.