

International Studies in Engineering

Results from more than 12 years of experience in offering the most comprehensive international engineering programme at German universities

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INTRODUCTION

At German universities, a total of 284 engineering degree courses (36 on bachelor's level and 248 on master's level) are implemented as international study offers [1]. The international study program of the Faculty of Engineering (FoE) at the University of Duisburg-Essen (UDE) is outstanding as it offers the only study program in Germany that covers a comprehensive range of engineering disciplines under the roof of one common consecutive structure. The name of the program is **I**nternational **S**tudies in **E**ngineering (ISE) and it is jointly offered since 2002 by the four departments of the FoE, namely

- Department Civil Engineering
- Department Electrical Engineering and Information Technology
- Department Computer and Cognitive Sciences
- Department Mechanical and Process Engineering

Within this paper we give an overview of ISE and its structure as well as we show how it enables and supports diversity in many facets.

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1 STRUCTURE AND GOALS OF THE ISE STUDY PROGRAMME

In 1998 the German federal government recognized that the number of international students in Germany went down dramatically. By the way of several funding programs the introduction of so-called international oriented degree programs was supported. UDE was amongst the first 13 German universities which introduced Bachelor and/or Master Degree Courses in 1998. This first Degree Course named “Computer Science and Communications Engineering” (CSCE) was a huge success for the FoE at UDE. Based on this experience the international oriented degree program “International Studies in Engineering” was developed with funding by DAAD and introduced in 2002.

The introduction of the study program ISE followed several goals on different levels and was designed to

- I. offer a broad spectrum of engineering study courses in order to attract more international students
- II. enable easy and flexible transitions between the degree courses as well as possibilities of double qualifications.
- III. qualify students for the international labour market

Apart from the goals given above, further aims are related to the internationalization concept of the faculty of engineering, like

- IV. the idea of building bridges between cultures and to enhance the multicultural (study) environment at UDE.
- V. strengthening the international links of UDE and the FoE by the establishment of new international partnerships. Alumni from foreign countries should become „Ambassadors of German Engineering” in their home countries
- VI. contributing to the enhancement of the number of foreign specialists in the German labour market

The ISE study programme was first introduced in the winter semester of 2002 and re-accredited in 2008 and 2014 by ASIIN. The programme for the next years consists of five bachelor courses and nine master courses. Some of them are implemented with different profiles such as the bachelor’s course computer engineering which is implemented with a profile in software engineering, and another one in communications. Figure 1 shows the structure and the full course offers of the ISE study programme.

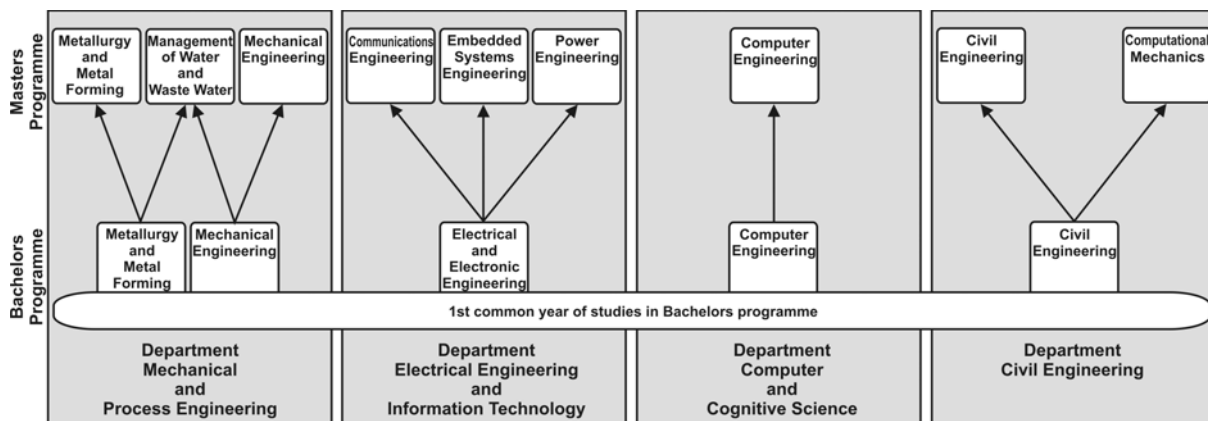


Figure 1: Structure of the ISE study programme

To reach the above described goals, all ISE courses on bachelor's level

- consist of a first common year of studies, in which the most fundamental engineering basics are taught.
 - Within this first year students can easily switch from one degree course to another.
- use English as language of instruction in all classes of the first common year of studies.
 - This helps foreign study to be easier and gives them one year of time to improve their German language capabilities, so that they can also follow classes which are taught in German language from the second year onwards.
- introduce German as language of instruction only after the first common year.
 - However, some classes are taught in English. The overall relation for every degree course is 50% in English language and 50% in German language.
- require at least a study period of one semester abroad, mandatory for all German students (to be spent at a partner university or a company)

Looking at the structure in figure 1 one can see that ISE offers different options for qualifications. A student can finish a bachelor degree course and apply for a job in industry. Students can continue their studies in a master degree course offered by one of the four departments. If they continue their master studies in the same department in which they graduated with a bachelor degree, they obtain in depth qualifications in a certain area. They can choose as well a master in a different field from a different department and thus obtain double qualification.

All in all, it can be said that these options are a first step in enabling diversity in terms of flexible ways to find the field of studies that fits best to the individual interests. It also offers a variety of combinations for bachelor and master degree courses ranging from a homogeneous qualification in one certain area of study to a double qualification.

2 ISE AND CULTURAL DIVERSITY

Studying engineering at a German University is highly recognized in many countries and is of great value for students from abroad. Additionally, the above described measures are good arguments for international students to choose UDE and the ISE programme for their studies. After the introduction of the ISE program in October 2002, the number of international students who obtained their university entrance qualification in a foreign country has more than doubled in the FoE. It can be shown that these high numbers result mainly by the introduction of the study program ISE. Table 1 gives the numbers of students in ISE bachelor and master degree courses, and differentiates them whether they hold a German university entrance qualification (GUEQ) or a foreign university entrance qualification (FUEQ).

It can be found from table 1 that today a total of 2,093 students are enrolled in one of the ISE degree courses. As the total number of students enrolled in the FoE at UDE sums up to 8,215, the contribution of ISE equals 25%.

Table 1: ISE student population over the years

		WS 02	WS 03	WS 04	WS 05	WS 06	WS 07	WS 08	WS 09	WS 10	WS 11	WS 12	WS 13	WS 14
Students with a FUEQ	B.Sc.	59	163	309	398	444	420	369	368	416	452	506	675	843
	M.Sc.	77	183	420	611	624	562	499	407	417	463	565	790	1,048
Students with a GUEQ	B.Sc.	34	41	56	74	68	74	70	76	75	85	100	163	130
	M.Sc.	1	6	12	9	11	16	20	37	51	58	60	64	72
Total ISE		171	393	797	1092	1147	1072	958	888	959	1058	1231	1692	2093

From the total number of ISE students a majority of 1,890 students holds a university entrance qualification from a foreign country. Therefore, ISE contributes to the cultural diversity in the FoE to a high extend. In summer semester 2013, students from 103 different countries have been enrolled in one of the ISE degree courses. This might be one the reasons why UDE has been ranked on top 3 amongst all German Universities with the highest numbers of master students with a foreign university entrance quality, and top 9 for students in a bachelor's degree course [2].

3 ISE AND DIVERSITY IN MOBILITY

The study program ISE contributes also in another way to cultural diversity. Soon after the introduction of the first internationally oriented degree course CSCE in 1998, UDE started international co-operations with some of the best universities in south east Asia, the National University of Malaysia (UKM), the Universitas Indonesia (UI) and the Nanyang Technological University in Singapore (NTU). Initially in conducting summer schools as well as exchange of guest professors, subsequently in developing and providing joint study offers with the partner universities and funding from DAAD. Until today, eight professors from UKM and three professors from UI have been visiting UDE for a one to two semesters stay, while they have contributed to to research and education. This visits helped to enrich the teaching culture as well as it helped to raise interest of UDE students in spending a semester abroad at one of the partner universities. Since 2010, the number of exchange students from UDE to one of the partner universities has risen sharply as presented in figure 2.

Especially the co-operations with UI and UKM became intensive in a way [3] that the FoE of UDE opened its own offices under the name "Mercator Office" at UKM in 2001 and at UI in 2003. UKM opened its own office at UDE under the name UKM-International Office in 2010. These offices serve to support outgoing exchange students during their preparation phase as well as incoming students during their stay at the host university.

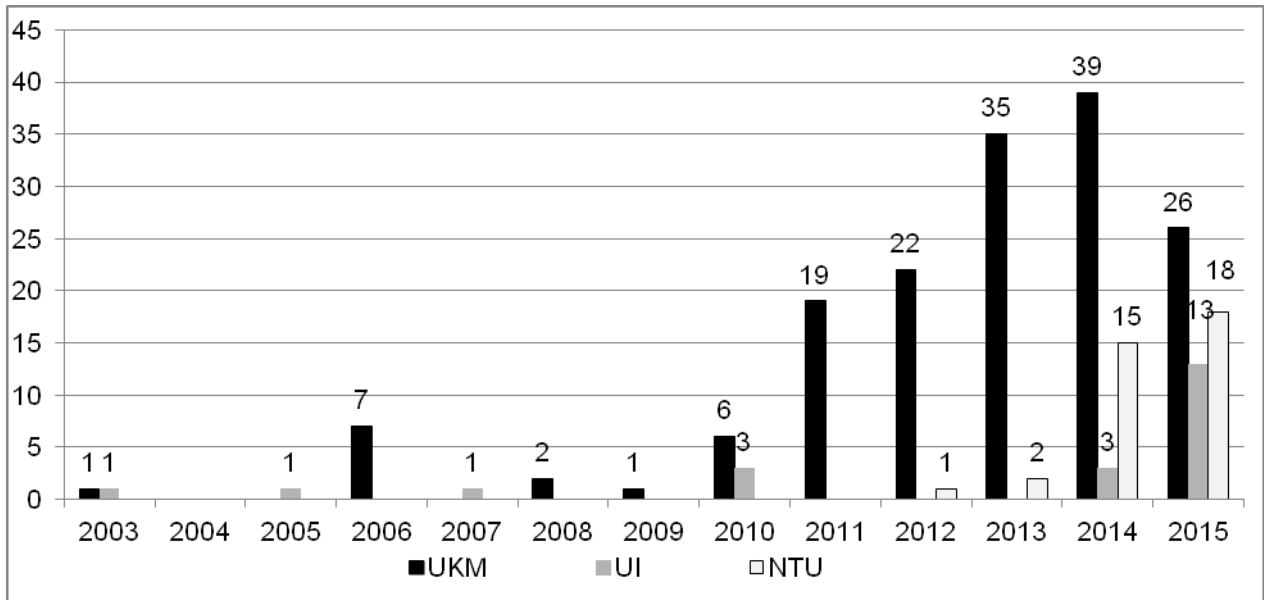


Figure 2: Population UDE outgoing students to partner universities in SEA

Furthermore, FoE of UDE together with UKM and UI have been developing ideas concerning joint study offers. As a first result, bi-directional exchange programmes were offered and so-called 3+1-Bachelor's scheme and 1+1-Master's scheme were developed to jointly offer double degree courses. While the exchange program is still the first choice for UDE students, students from UKM and UI going to UDE prefer clearly the double program. By today the following double degree courses were offered.

Table 2: offered double degree courses

	Double Degree Bachelor of Science	Double Degree Master of Science
UDE-UKM	- Mechanical Engineering - Electrical Engineering - Civil Engineering	
UDE-UI	- Electrical Engineering	- Metallurgy and Metal Forming

The first double degree students from both partner universities came to UDE in 2003. At first, the numbers were quite small but soon they increased up to 24 students from UKM in 2006. Including the intake in 2014, a number of 132 students from UKM, 9 students from UI and 18 students from NTU came to UDE. It is worth to mention that the dropout rate equals zero, meaning a 100% success rate in the double degree programme. The development in numbers for double degree students of UKM and UI is shown in figure 3.

Double degree students at UDE become regular degree seeking students in a certain degree course of the ISE study program. In the 3+1 and 1+1 double degree program, the students from UKM and UI spend their final year of studies at UDE in an ISE degree course. As the great opportunity of subjects taught 100% in English language only holds true for international students starting in the first common first year of a bachelor's degree course of the ISE program, students in the double degree program have to cope also with lectures offered in German language soon after their arrival in Germany.

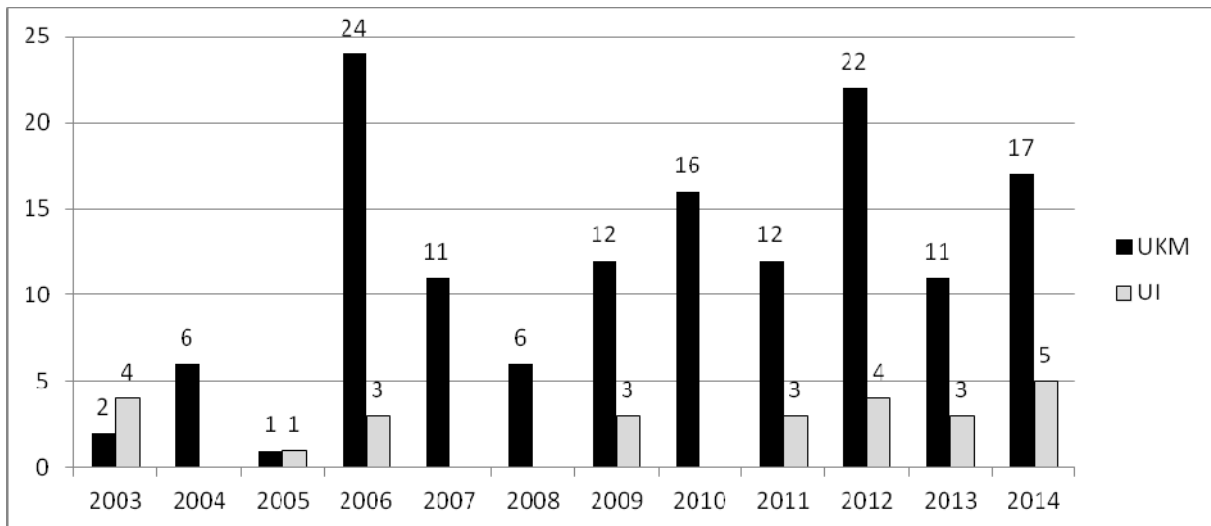


Figure 3: Population of incoming double degree students at UDE

During the last year several steps have been taken to improve the double degree programs. Measures include

- better preparation in German language in advance by way of offering special German language classes with a focus on technical German/ German for Engineers right from the start in Mercator Offices,
- adjustment of curriculum whenever possible, e.g. when a new curriculum is required due to accreditation rules
- adjustment of semester schedules

By today each double degree course consists of an average of 57 ECTS with 60 ECTS being the maximum number allowed and with an average of 30.6 ECTS which can be earned by usage of English language. With respect to the measures described above it could be observed that the average study times of the UKM double degree students went down from 22 month for the intake in WS 2007/08 to 12 month for the intake of batch 2012/13. Therefore, ISE can be said to be the foundation for successful developments of double degree programs.

Apart from the regular study offers the partners always seek to add some special cultural courses to the double degree or exchange curriculum, like excursions to German industry for double degree students or exotic events like taking part in a Malaysian wedding for UDE exchange students as shown in figure 4.



Figure 4: UDE exchange students at the marriage of a Malaysian couple

It has been shown that the double degree program as well as the exchange program might contribute to a better understanding of cultural dynamics in co-operations between Malaysia and Germany [4] as well as these programs had a great impact on personality development of students enrolled in the double degree program [5] and improvement of global engineering skills [6].

It is also interesting to look at the alumni as it was one of the objectives of the introduction of the study program ISE to enhance the number of foreign specialists for the German labour market and to win „Ambassadors of German Engineering” in the students’ home countries.

A total of 54% of all graduates in a bachelor’s degree course of the study program ISE continues in one of the master degree courses of the study program ISE.

Looking at the alumni of the double degree program with UKM it can be found that 25% of the alumni did something in relation with Germany after completion of the double degree, see figure 5.

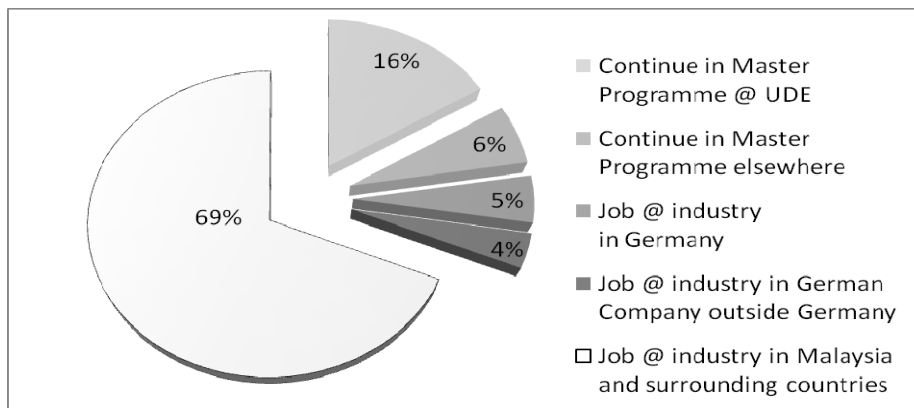


Figure 5: Where the double degree Alumni go to

4 CONCLUSION AND OUTLOOK

Within this paper we have shown that by means of the introduction of a study program in engineering it is possible not only to reach such goals as described in section 2 of this paper, but also to foster cultural diversity in many ways. Based on the experiences and outcomes of current developments, the introduction of further partners to the University network like University Tenaga Nasional (UNITEN); Malaysia, Zhengzhou University (ZZU), China and University of Computer Studies, Yangon (ACS), Myanmar are promising. The overarching goal is to promote and to expand high quality degree programs and possibilities for further exchange and double degree programs.

Furthermore, within several projects with funding from governmental sources special ways to study engineering at German universities are under research and development. Within the project with the name PROSalamander [7] the study program ISE supports people living in Germany and holding an engineering degree acquired from abroad which is not accepted by German authorities in order to qualify them for the German labour market. Furthermore, we develop new ways to study engineering at a German university without holding a recognised university entrance qualification [8]. In doing so, a combination of entrance test and special preparation courses had been developed. The first five students have been enrolled as students in ISE via this program in October 2014. They completed their first exams in March 2015 In their first exam, they have shown better results as the average of students, as their average mark is 2.12 where the average mark of all students is 3.53

Furthermore, we developed special language courses in German language together with a book entitled "German for Engineers" [9] to improve the students' language competencies, their linkage to Germany, and in particular in their forthcoming professional career.

A final proof of success of the study program ISE can be found at the CHE Multirank [10] where the ISE degree courses in the field of Electrical Engineering certainly helped that UDE reached the top position out of all German Universities and position number 3 out of the 147 European universities which took part in this ranking.

REFERENCES

- [1] DAAD: International Programmes in Germany 2015
<<https://www.daad.de/deutschland/studienangebote/international-programs/en/>>
last visit: 01.04.2015
- [2] DAAD, Wissenschaft Weltoffen 2007, HIS GmbH, ISBN 978-3-7639-0450-1
- [3] Hunger, A., Shamsuddin, H.A.; Muchtar, A. (2013) Over 10 Years of Cooperation between Universiti Kebangsaan Malaysia and University of Duisburg-Essen, Germany -Case Study of the Development of a Fruitful Partnership In *Proceedings Social and Behavioral Sciences* Volume 102 pp. 11-20
- [4] Hunger, A., Redzuan Lee, M. N., Muchtar, A., Sulehan J., Mastor, K.A.; Shahrum A. (2011) Contribution to the Understanding of Cultural Dynamics in Co-operation between Malaysia and Germany In *Proceedings Social and Behavioral Sciences* pp. 204-212; Elsevier Publishing
- [5] Hunger, A., Redzuan Lee, M. N., Muchtar, A., Sulehan J., Mastor, K.A.; Shahrum A. Monika, J. (2010) Investigation on the Personality Development of Students Enrolled in UKM-UDE Double Degree Programme. In *Proceedings of the International Congress on Engineering Education (ICEED 2010)*, Shah Alam, Malaysia, pp. 73-78. ISBN 978-1-4244-7310-6.
- [6] Hunger. A; Werner. S; Marzuki. M.Global Engineering Skills – Practice and Perspective of Joint Educational Programmes in Engineering between a German and Malaysian universities in *Proceedings of the SEFI 2014 Conference*, Birmingham, p. 119
- [7] Heinrich, C. Die bunte Uni in *Zeit-Online*
<<http://www.zeit.de/2013/44/universitaet-duisburg-migranten-bildungsaufsteiger>>
last visit: 02.04.2015
- [8] Hunger, A., Fast track bachelor admission for excellent indonesian students
<<http://www.way2studying.de/material>> last visit: 02.04.2015
- [9] Kärchner-Ober, R. (2015) *Deutsch für Ingenieure*. Ismaning: Hueber.
- [10] CHE Hochschulranking 2014/15 <<http://ranking.zeit.de/che2014/de/>>
last visit: 01.04.2015