

Curriculum Design and German Student Exchange for Sino-German Bachelor Program Majored in Optoelectronics Engineering

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ABSTRACT

Different higher education backgrounds in China and Germany led to challenges in the curriculum design at the beginning of our cooperative bachelor program in Optoelectronics Engineering. We see challenges in different subject requirements from both sides and in the German language requirements for Chinese students. The curriculum was optimized according to the ASIIN criteria, which makes it acceptable and understandable by both countries. German students are integrated into the Chinese class and get the same lectures like their Chinese colleagues. Intercultural and curriculum challenges are successfully solved. The results are summarized to provide an example for other similar international programs.

Keywords: cooperative bachelor program, optoelectronics, microsystems, student exchange

1. INTRODUCTION

With the fast development of economic globalization and the internationalization of education, the cultivation of international competitive talents has become one of the hot topics in the Chinese higher education universities^[1-3]. Like many world famous universities, Chinese universities pursue to realize the internationalization education to improve the higher education quality^[4,5]. The Chinese "National long-term education reform and development plan (2010-2020)" also clearly pointed out that we need to strengthen international exchanges and international cooperation, need to establish more advanced concepts and transfer good experiences from advanced countries, and finally improve the international level of education quality in China^[6,7].

However, during practical implementation of international cooperation program, both sides from domestic and foreign universities always face some difficulties of matching both curricula and other non-academic problems caused by the different higher education backgrounds. Therefore, it is necessary for domestic universities to make some adjustments to the corresponding curriculum system according to international standards like ASIIN accreditation standard^[8]. Additionally it is also necessary to take some practical measurements to solve the problems in the international cooperation program.

In this paper, we report our international cooperative exchange students bachelor program majored in Optoelectronics Engineering collaborated between the University of Shanghai for Science and Technology (USST, China) and Technical University of Applied Science in Regensburg (OTH, Germany). Similarly, in the beginning, great challenges were in different subject requirements from both sides and in the German language requirements for Chinese students. These problems were solved step by step. Curriculum design and credit point recognition have been emphasized before starting the exchange program. Finally, the curriculum was optimized according to the ASIIN criteria, which makes it acceptable and understandable in both countries. And, what's more, Up to now, this cooperative program is successfully running for 2 years already.

In the next Chapter, backgrounds of the participating universities are explained. Chapter three shows the structure of the bachelor curriculum. Student exchange procedure is described in Chapter 4. Conclusion and outlook are given in Chapter five.

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2. UNIVERSITIES BACKGROUND

2.1 University of Shanghai for Science and Technology

University of Shanghai for Science and Technology (USST) is located in the international metropolis of Shanghai with long history of over 100 years. USST contains 18 colleges, 44 institutes, 26 research centers. At present, totally 24900 full-time students are enrolled in USST. Among them, 17700 undergraduate students are enrolled within 54 bachelor program, and total 7200 graduated students study in 93 master programs & 6 doctoral programs. USST has over 1670 professional faculty members including 8 Chinese top scientists (titled "academician") and dozens of all types of national talents.

USST is focused on the orientation of cultivating "Engineering, Innovation and Internationalization" types of talents for industry. USST has very wide international connection with foreign universities. Up to now, MOE (Ministry of Education) of China has approved 11 cooperative bachelor programs collaborated between USST and the different foreign universities from 15 countries. Each year, over 1000 oversea students study within USST campus in Shanghai.

The school of Optical-electrical and Computer Engineering (OECE), after developing for more than half a century, has become a famous national industrial school with very good reputation in the opto-electrical engineering academic and industrial field. OECE has been honored as the "national excellent industrial Engineer-cultivation practicing and training basement". Especially, Optoelectronics Engineering bachelor program is the best one among all of the 11 bachelor programs in OECE. The latest newsletter reports that Optoelectronic Engineering bachelor program of OECE in USST is ranked No.9th within national over 200 the same bachelor programs. Optical Engineering discipline owns very excellent and very famous scientists working as the faculties, and the excellent experimntal condition.

2.2 OTH Regensburg

The Ostbayerische Technische Hochschule (OTH) Regensburg is a German University of Applied Sciences, located in Regensburg, Bavaria. Nearly 11.000 students are enrolled in Bachelor and Master Programs of eight faculties. The focus is on technical topics, 70% study engineering programs. But there are also business studies, architecture, design, social and healthcare science programs.

The faculty "General Studies and Microsystems Technology" offers the bachelor program "Microsystems Technology". The usual study program is offered completely in Regensburg with German language. But there is a study branch "Optoelectronics" together with USST where students do an exchange year in China and attend English lectures. The faculty has also a strong focus on research with intense industry collaborations and an own clean room facility.

OTHR has very strong faculties in the measurement test technology and related fields. All of the school's teaching programs are assessed by the Bavarian Education Department and are awarded in the European Union. The Institute of Sensors has strong background support and very close connection with industrials, such as Brose, Evonik, Schaeffler, Audi, Continental, Infineon, Osram, Siemens, ZF and other international leading German companies. The cooperative education project was approved and funded by the German Academic Exchange Center (DAAD) and the state government, and was supported by the Ministry of Education.

2.3 Background of cooperation program

OTHR and USST signed a general Memorandum of Understanding in October 2013 for cooperation in transnational education, promoting general professor and student exchange between both institutions. In 2016, Memoranda of Agreement between USST, OTHR and Coburg University of Applied Sciences and Arts (CUASA) were signed to cooperate in student education in the Bachelor program which is described in this article. They provide a framework for the cooperation between CUASA, OTHR and USST in the bachelor study programs „Technical Physics“ (study program branch „Engineering Physics“) of CUASA, „Microsystems Technology“ (study program branch „Optoelectronics“) of OTHR and „Optoelectronic Engineering“ of USST.

In the first and second year (semester one to four) USST students will study at USST in Shanghai. In the fifth semester USST students will study at CUASA in Coburg. In the sixth semester students need to do an internship (minimum 18 weeks). In the seventh semester they can attend lectures of the study program „Microsystems Technology“ (study program branch „Optoelectronics“) at OTHR and they can prepare their bachelor thesis at OTHR. Alternatively, in the

seventh semester they can stay at CUASA and participate in lectures of the study program „Technical Physics“ in German language and prepare their bachelor thesis at CUASA.

In our cooperation program, for the German students, in the first year (semester one and two) students will study at OTHR in German language. In the second year students will go to USST (third and fourth semester) and study in English language together with Chinese students in one class. In the fifth semester students need to do an internship (minimum 18 weeks). In the sixth and seventh semester students will study at OTHR (6th semester in German language, 7th semester in English language) and complete their bachelor thesis.

3. STRUCTURE OF COOPERATION BACHELOR CURRICULUM

3.1 Some challenges in the cooperation program between USST and OTHR

In the beginning, after determination of the cooperation program, both sides discussed about the detailed planning of the Bachelor program. Then both sides of cooperation met some difficulties in matching courses and credits recognition. The reason is that, in the German university, the credit point calculation method is different from Chinese universities. For example, in Germany, the total learning hour of one course contains not only the contact hour that teacher uses in teaching in the class, but also includes the study hours (workload) that the students use for review and homework of the course. In China, the credit points of one course only depend on the number of teaching hours in the class (or in the lab). Generally, for the same course, the OTHR counts one or two more credit points than USST counts.

Secondly, even for the same program named as “Optoelectronics Engineering”, OTHR and USST has different teaching plans and syllabus for each course. On one side, each university has its own advantage and benefit characteristics in some special disciplines. How to match the total teaching plan and make the exchange students can satisfy the requirements from both sides is the key problem for good cooperation.

Thirdly, language problem is also a key point for the involved exchange students. For German students, they need to learn little Chinese for coping with the daily life in China, and for Chinese students, they also have to learn the German language for the study and life in German, even for the study requirement of VISA application.

Fourthly, communication problems also exist between two the partner universities due to different culture backgrounds from two countries. Especially, if one partner wants to change a module or something else, it is necessary to inform their partners so that the necessary correspondence should also be made to keep the running of cooperation program normally.

3.2 The solution ways for the problems in the cooperation program between USST and OTHR

Fortunately, facing with these difficulties, after repeated friendly consultations, we were optimistic and finally we found good solutions for the described challenges.

For the credit point recognition, the fundamental way is that we also received the German ASIIN accreditation requirements and standards, and make the two partners to discuss this issue in the same standard. We recruited the European credits according to the requirements of ASIIN and make a credit point recognition table, so that the German side can understand and transfer the credits.

For the second problem, both sides agreed to exchange the best advantage courses for the partner. Thus, for OTHR students, they come to USST for the second year, to learn applied optics, analog circuits, digital circuits, and C++ programming courses, they also have very good conditions for their lab courses. What’s more, they can learn in classes which are supervised by some excellent and professional professors. For USST students, they are sent to OTHR to learn the fiber optics, laser principles and what’s the most important thing is that they have the opportunity to find the internship position in German company.

Thirdly, for language problem, both sides adopted the English teaching courses. The USST students are selected by the interview with the German professors, and they also need learn the German language to reach A2 level before they go to Germany. For OTHR students, they are very good in English communication, and they learn simple Chinese language in China or in OTHR before they study in USST.

Fourthly, regular communication meetings are done for discussion about our cooperation program. During the regular program meeting, some issues from both sides are put forward for discussion, and finally we sign the decision we commonly made for solving the problems of our program. What's more, for daily communication, we write email to our partner to inform them about important issues that happen related with the program as early as possible.

3.3 The bachelor curriculum for German students in this cooperative Bachelor program

In Table 1, the Mutual Recognition of Courses and Credits between OTHR and USST students majored in Optoelectronics is shown. In the 3rd and 4th semester, OTHR students will learn the courses together with USST students in English teaching class. GCPs means the German credit points, SWS means how many class teaching hours per week, and CCPs refers to Chinese credit points. From the table, the credit points can be transformed between USST and OTHR.

In the 6th and 7th semester, USST students are allowed to do their internships in Germany and learn some courses in OTHR. This is really a good opportunity for Chinese students to learn in the German industry.

Table 1. Cooperative Bachelor Curriculum Structure

Semester Location	Course Modules	GCPs 德国学分	SWS 周学时	CCPs 中国学分	课程	Courses
3 USST	Mathematics III	4	3	3.0	概率统计与概率论 (英)	Probability and statistics theory
	Physics I (2)	5	4	4.0	电磁场及电动力学(英)	Electromagnetics & electrodynamics (Eng.)
	Analog circuits	5	4	4.0	模拟电路(英)	Analog circuits (Eng.)
	Data structures & software design	7	6	6.0	数据结构与程序设计(英)	Data structures & software design (Eng.)
	Packaging	3	2	2.0	封装技术(英)	Packaging (Eng.)
	Chinese language	4	4	4.0	中文 I	Chinese language I
	MATLAB	2	2	2.0	MATLAB(英)	MATLAB (Eng.)
SUBTOTAL		30	25	25		
4 USST	Digital circuits	5	4	4.0	数字电路(英)	Digital circuits (Eng.)
	Microcontrollers	5	4	4.0	单片机原理(英)	Single-chip microcomputer (Eng.)
	Thermodynamic	4	3	3.0	热力学(英)	Thermodynamics (Eng.)
	Solid state physics I	4	3	3.0	固体物理 I (英)	Solid state physics I (Eng.)
	Physical optics	2	2	2.0	物理光学(英)	Physical optics (Eng.)
	Signals and systems	4	3	3.0	信号与系统(英)	Signals and systems (Eng.)
	Chinese language II	4	4	4.0	中文 II	Chinese language II
	Project of single-chip microcomputer	2	2	2.0	单片机课程设计(英)	Project of single-chip microcomputer (Eng.)
SUBTOTAL		30	25	25		
6 Coburg or Regensburg	Industry internship	25	16 weeks	16.0	工业实习(英)	Industry internship (Eng.)
	Practice related course	3	3	3.0	专业实践(英)	Practice-related course (Eng.)
SUBTOTAL		28	3	19		
7 Regensburg	Optoelectronics	8	6	6.0	光电子学(英)	Optoelectronics (Eng.)
	Fiber optics	5	4	4.0	光纤光学(英)	Fiber optics (Eng.)
	Photonics and laser technology	5	4	4.0	光子学与激光技术(英)	Photonics and laser technology (Eng.)
	Bachelor Thesis	12	12 weeks	12.0	毕业设计(英)	Bachelor thesis (Eng.)
SUBTOTAL		30	14	26		

4. STUDENT EXCHANGE

4.1 Exchange Students Regulations

For the students exchange program, both partners have signed the detailed cooperation agreement file. The file includes the detailed information about the module, syllabus, and regulations.

The exchange Students shall be selected and nominated by the home institution based on the qualities mentioned below:

- a. Good academic record;
- b. Appropriate degree of fluency in English;
- c. A2 in German (Goethe institute) or equivalent for USST students;
- d. Relevant and appropriate curricula interests;
- e. Other criteria that the home or host institution may wish to impose, given that such criteria are agreed on by mutual consent;
- f. Approval of the host institution. USST students are selected by an interview with professors from the German host institutions.

With respect to the studies and the exams including repetition exams the local regulations of the partner, which is responsible for the respective module, are valid. Exam achievements will be transferred to the home university of the students.

4.2 Learning Experience for OTHR Students at USST

An integral part of the Bachelor curriculum is the exchange of German students during third and fourth semester for one year to USST. The first two German students for an exchange year started in winter semester 2015/16 at USST in Shanghai.

The first two German OTHR students finished their study in USST and been back to OTHR in 2016. They had deep impression with USST and Shanghai. The most benefit they obtained from the one year exchange study in USST is that they know about China and they can feel deeply the difference between Chinese higher education and German higher education. They are very interested in Chinese culture, Chinese language, and taste Chinese food in USST campus. One of the students explained, he has the deep feeling about the different teaching methods between OTHR and USST. USST professors pay more attention to the theoretical reasoning and calculation, some of theoretical courses are deep and difficult to understand, and in OTHR, German professors pay more attention to the cultivation of practical ability, they have more connection between theory and the practical application. He though, both USST and OTHR has their own good aspect, and both of them will become better if they learn more from the cooperation partner. They had good memory in their life in USST and also they have good friendship with Chinese classmates.

Currently, the second cohort of German students is at USST and they are very satisfied with curriculum and study conditions.

4.3 Learning Experience for USST Students at OTHR

A first enrollment of USST students at OTHR is envisaged for the winter semester 2017/18. Each year there is a maximum of 15 places at OTHR. Only in the winter (autumn) semester, the courses of the seventh semester are offered in English.

The students are accepted and enrolled at their respective home universities; in the exchange semesters they will be enrolled additionally at the respective partner university. OTHR will help to find but cannot guarantee accommodation for USST students.

Up to now, two USST students have been accepted to do their internship in OTHR experimental lab. They are very satisfied with the experimental condition, and very deeply impressed by the rigorous regulations of the experimental operation management. The first enrollment USST students are eager to study in OTHR campus in the next semester.

5. CONCLUSION AND OUTLOOK

The paper reports the bachelor exchange program majored in Optoelectronics Engineering between USST and OTHR. The challenges of the cooperation program have been analyzed and solved in the practical implementation of the program. USST has optimized the curriculum according the German ASIIN accreditation standard; OTHR has also modified their teaching plan especially for the exchange students to match the USST teaching plan. It will ensure that OTHR students can attend the best and most advantageous courses for them in USST. It is also important to enhance the exchange students' language ability, not only in English communication ability, but also the partner counties language, to know more about the partner country's culture. The first experiences show that this exchange program gives students very good experience in scientific knowledge as well as in intercultural and social ability.

It is planned to extend this exchange also to the third partner of our bachelor program, the University of Applied Sciences Coburg. Also students from Coburg can go to USST for the third and fourth semester. With this increase of exchange, it is planned to broaden this existing program.

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