

COOPERATIVE STUDY PROGRAMS IN ENGINEERING – A WAY TO COMBINE ACADEMIC AND VOCATIONAL EDUCATION

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Abstract

Typically, dropout rates in engineering study programs are relatively high. The reason is that engineering courses are intellectually demanding and time consuming. These facts not only result in reduced study success but also discourage interested study applicants from enrolling in engineering study programs. As an alternative, young people who are doubtful about their intellectual performance decide for a vocational training instead of higher education.

With the increasing lack of engineers in the last years, universities had to develop ideas how to motivate potential students to enroll in engineering programs and how to improve the graduation rates. The aim was to motivate interested young people not (only) to start a vocational training but (also) a university education. Thus, German universities developed a study course model, which combines higher education and vocational training ("Dualer Studiengang"). Normally, one university cooperates with one enterprise to educate its future staff in that study program.

The Faculty of Civil Engineering at HTWK Leipzig developed a study model for a bachelor program in civil engineering, which allows to educate not only apprentices from one enterprise but from several interested practice partners.

After an introduction, the paper gives an overview about the German study model "Dualer Studiengang" in general. The authors furthermore inform about the special study model Cooperative Study Model in Civil Engineering at HTWK Leipzig. They provide information about the implementation, facts and figures as well as experiences after running the program for around 10 years. The conclusion is that a cooperative education, which combines academic and vocational training, can be successful and may contribute to a reduction of the lack of qualified engineers.

Keywords: engineering education, cooperative education, lack of engineers

1. INTRODUCTION

Engineering faculties at most universities face declining enrollment and high dropout rates. Today, it is hard to motivate young people to study engineering sciences. Potential students often are concerned of the high workload in engineering programs as well as of the demanding topics. Some of them are not confident enough to enroll in an engineering study course because they doubt in their intellectual abilities.

Opposed to that facts, building industry as well as (structural) design offices complain about a lack of young engineers. In Germany, currently there are around 113,000 job vacancies for engineers. Mainly, civil and structural engineering jobs are available (Verein Deutscher Ingenieure 2020). In the beginning of 2020, there were 5.5 job vacancies for every unemployed civil or structural engineer. The Faculty of Civil Engineering at Leipzig University of Applied Sciences (hereinafter referred to as the HTWK Leipzig), in cooperation with a vocational training institute, found a solution to reduce the lack of civil and structural engineers by motivating students to start both a vocational training in building industry and a study course in civil engineering. A similar study program has been already established in Germany under the name "Dualer Studiengang". The innovation of the study model developed by HTWK Leipzig was the cooperation with various construction companies under the guidance of a vocational training institute.

In the following, the authors present information about the German cooperative study course “Dualer Studiengang”. Furthermore, they introduce the innovative HTWK Leipzig’s Cooperative Study Model in Civil Engineering including facts and figures. At the end of the paper, the authors share their experience and present a conclusion.

2. COOPERATIVE EDUCATION “DUALER STUDIENGANG”

In Germany, cooperative education has a tradition for around 50 years. It is defined as a higher education study course which is combined with practical education periods in an enterprise. The difference to regular higher education at universities is the higher share of practical training which varies between the different study courses. Contrary to part time studies, the cooperative education is characterized by integrating practical and/or vocational elements in the academic education (Hochschulrektorenkonferenz 2020).

The advantage for students is that they are able to obtain two recognized graduations in a reduced time, a first-cycle degree in a higher education study program as well as a degree in a vocational training course. This is possible because practical and academic training are conducted in parallel.

The essential components of cooperative education are:

- Duality: Education at both educational partners, university and enterprise, is synchronized. That means coordination regarding organization and content. Tasks in the academic part and in the practical part must be linked to each other.
- Scientific character of the academic part: A cooperative study program has to be an academic education on scientific level. It is recommended to plan at least 50 per cent of the time of the cooperative education to be taught at the academic partner institution (Wissenschaftsrat 2013).

In Germany, the following systems of cooperative education will be offered:

- Vocational Training Attendant Learning Programs
- Vocational Training Integrated Learning Programs
- Job Attendant Learning Programs
- Job Integrated Learning Programs
- Work Attendant Learning Programs
- Work Integrated Learning Programs (Wissenschaftsrat 2013).

In cooperative education, universities normally work with only one big enterprise as cooperation partner, such as Siemens, Airbus or Deutsche Bank (TarGroup Media GmbH & Co. KG 2020). The HTWK Leipzig has chosen a different system.

3. COOPERATIVE STUDY MODEL AT HTWK LEIPZIG

For around 10 years now, the Faculty of Civil Engineering offers a cooperative education model which combines vocational education in building industry with a first-cycle study program in civil engineering.

3.1. Basic idea

Reason for implementing the cooperative study model was to support local building industry in the Federal State of Saxony to recruit potential engineers and trainees. Saxon building industry is characterized by smaller and mid-size building companies which currently have problems to find trainees as well as skilled engineers. Each of the companies alone would have not been able to start a cooperative education with an academic partner. That’s why, under assistance of a vocational training institute, the Cooperative Study Model in Civil Engineering at HTWK Leipzig was implemented.

In the State of Saxony, the theoretical part of the vocational training is offered and conducted by one vocational training institute for all building-related jobs which require professional training. That training institute, the “Bau Bildung Sachsen e.V.” (2020) combines four supra-company training centers in Saxony, offering the theoretical part of vocational training for more than 20 jobs in the building industry, such as bricklayer, concrete/reinforced concrete worker, road builder or carpenter (Bau Bildung Sachsen e.V. 2020).

In offering the cooperative study model, young people could be motivated to start an academic training even though they are concerned to be able to finish an engineering study program. Due to the parallel vocational training, students have the possibility to obtain at least a graduation in a building-related profession even if they fail in the academic part of the cooperative education. Furthermore, the students will be involved in the building company at a very early stage of their academic education which may encourage a long term loyalty.

3.2. Educational requirements and schedule

The Cooperative Study Model in Civil Engineering at HTWK Leipzig has a regular education time of four years (HTWK Leipzig 2020). Students will be enrolled in the regular Bachelor Program in Civil Engineering at the Faculty of Civil Engineering. After successful completion of the Bachelor study course and the vocational training in a build-related profession, graduates obtain a Bachelor’s Degree in Civil Engineering as well as a vocational training graduation.

Interested applicants for the study model need to proof, beside a school leaving certificate which qualifies for academic education at a higher education institution, a position as a trainee for vocational training at a partner company with their application for the Bachelor Program in Civil Engineering at HTWK Leipzig at the latest. Accepted applicants start with the vocational training in June of the first year and with the academic program in October in the same year (see Figure 1).

For the vocational education, trainees in Germany receive between 800 euro and 1,200 euro. The sum depends on the profession and the year of training, while the apprenticeship remunerations increase over the years.

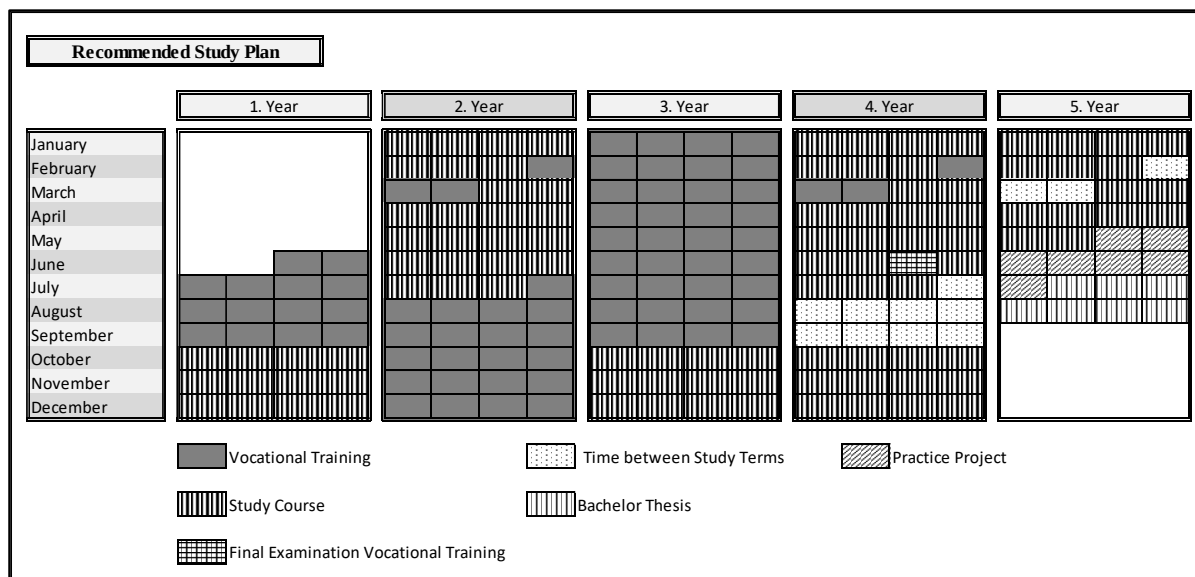


Fig. 1. Recommended study plan in the cooperative study model at HTWK Leipzig

From October of the first year, students follow the courses in the regular Bachelor program at the faculty. In the second year, between end of February and the first two weeks in March, when the regular Bachelor students have a free time between the winter term and the summer term, cooperative students continue

their vocational training. The vocational education includes theoretical education in the vocational training institute and practical training in the building companies. Its main part starts at the end of July in the second year and will be finished at the end of September of the third year. While that time, students remain matriculated but have been granted leave of absence from their studies. In February/March of the fourth year, the last part of the vocational training follows which will be completed by the final examinations of the vocational education (see Figure 1).

In October of the third year, students return to university and finish their studies in the middle of the fifth year. In that time, they attend all courses of the regular Bachelor program at the faculty. With the Bachelor's Degree, motivated graduates are able to apply for a Master program at HTWK Leipzig or any other university in Germany and worldwide.

3.3. Facts and Figures

Since the year 2011, 193 students have been enrolled in the Cooperative Study Model in Civil Engineering at HTWK Leipzig (see Figure 2). 60 students graduated until the year 2019 (see Figure 3).

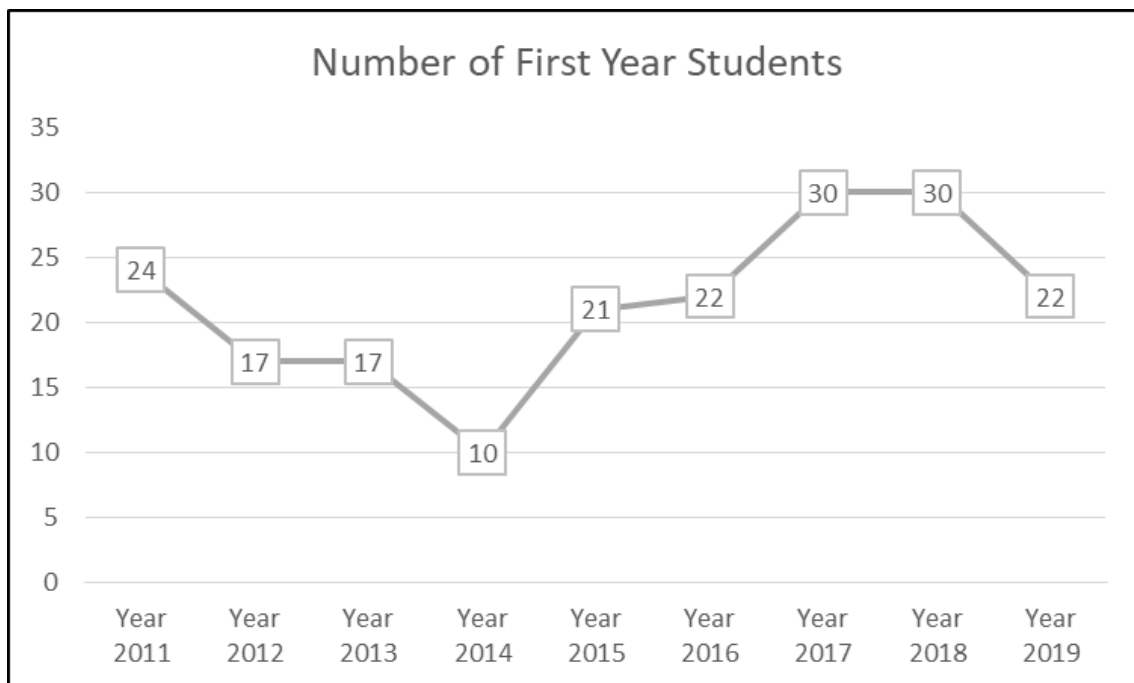


Fig. 2. Number of first year students in the Cooperative Study Model at HTWK Leipzig in the years 2011-2019

It is very interesting to see a comparison of the duration of studies in the Cooperative Study Model and the time students need to graduate in the regular Bachelor Program in Civil Engineering at the faculty (see Figure 4). The authors have to point out that the cooperative education is scheduled for four years while the study period for the regular Bachelor program is only three years. The analysis in Figure 4 shows in four of six graduation periods a similar duration until graduation in both programs. This means that, in average, students in the regular Bachelor Program need around one year more to graduate than students matriculated in the Cooperative Study Model. The facts are surprising because cooperative students leave the university for one year, between the second and the third year, for the main part of their vocational training. Of course, the students receive a theoretical education in the building-related profession but not on academic level. While implementing the cooperative education at Faculty of Civil Engineering, the authors were concerned if students, after one year of absence from university, could reconnect the learning experiences from the first academic year with the teaching contents of the following terms. But, the students seem to be successful in doing that.

About the reasons for the faster graduation of cooperative students, the authors only can speculate. Students in the Cooperative Study Model seem to be very motivated and focused. Furthermore, maybe their future employers are interested that the students graduate as soon as possible to be available as employees.

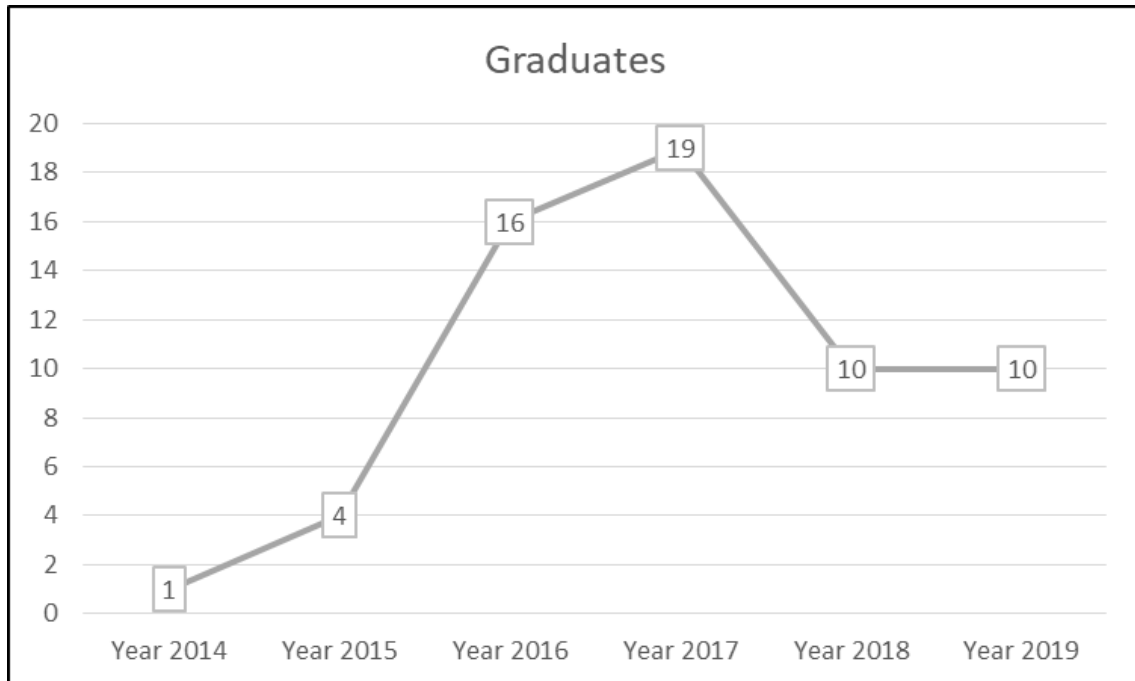


Fig. 3. Graduates in the Cooperative Study Model at HTWK Leipzig in the years 2014-2019

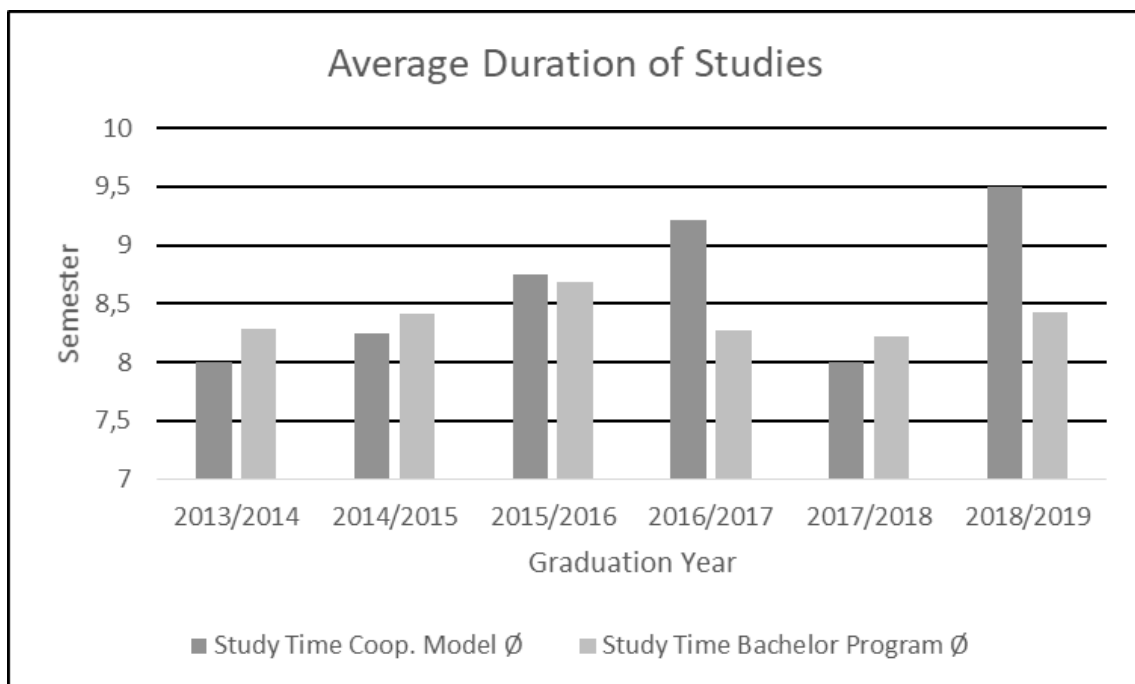


Fig. 4. Average Duration of Studies in the Cooperative Study Model in comparison with the regular Bachelor Program in Civil Engineering at HTWK Leipzig

4. EXPERIENCES

The Faculty of Civil Engineering at HTWK is running the Cooperative Study Model for around 10 years now. Even though the number of students is fluctuating, the study model can be considered as a success. Not only students benefit from the cooperative education but also cooperating building companies.

With the chance to graduate at a higher education institution, cooperating building companies can motivate qualified young people for a vocational education. They further have the possibility, at a very early stage, to establish a long term relationship to the young future engineers. Additionally, the companies benefit from the knowledge transfer from university to practice.

While creating the Cooperative Study Model, the authors were concerned about the high work load in the program, especially because the cooperative students have to use the free time between the semesters for continuing their vocational education. However, in the year 2012, the Faculty of Civil Engineering at HTWK Leipzig carried out an evaluation regarding the work load in the Cooperative Study Model. The students were asked whether the double work load resulting from the vocational training in combination with the academic program is too high. Nearly all asked students answered that the work load is manageable because vocational training and academic education are interlocked in an ideal way. Furthermore, they said that having the chance to combine the theoretical education in the vocational training institute and at the university with the practical education in the building companies constitutes an advantage in comparison to their fellow students in the regular Bachelor programs.

5. CONCLUSIONS

Cooperative education combines two components of the German Educational System in a successful way: the practice-oriented vocational education in a building-related profession and the academic education at a university.

Due to the ideal interlocking of practical training and higher education, students of the Cooperative Study Model in Civil Engineering at HTWK Leipzig are able to obtain two full graduations in only four years: a certification about completion of a vocational training in a building-related profession as well as a first-cycle degree in civil engineering of a German university of applied sciences. Statistical analysis over the last years show, that the vocational training and the academic education are interlocked in a perfect way to avoid an overload in the cooperative students' work load.

By offering the cooperative education, the Faculty of Civil Engineering at HTWK Leipzig motivated over 190 young people to enroll in a civil engineering study course. Otherwise, probably, they only would have been started a vocational training. By this way, the partners in the Cooperative Study Model contributed to a reduction of the lack of engineers.

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