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Support Work Experience of Students in Civil Engineering

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Abstract

Civil engineering is a field with big demand on the theoretical background and practical experience. Very good theoretical knowledge students acquire during their studies at university, which is in many cases supplemented by theoretical knowledge gained at foreign universities in the frame of the student mobility. In conditions of the Czech educational system, however, there is still rather limited use of opportunities to enrich students' theoretical education with practical experience in areas that students are studying. There are more ways to bring students to practice. One possibility is to include a mandatory practice in the curriculum of students. Other options can be in the form of organized internships for selected students in companies or excursions of students to major constructions with the participation of persons responsible for their realization. The paper is focused on the characteristic of basic approaches leading to the practical experience of students organized by Brno University of Technology, Faculty of Civil Engineering, and identification of options for its further development.

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1. Introduction

Key activities of Brno University of Technology include education, science, research and development, innovations, art and other activities. Additional activities are directly associated with the key activities, as their purpose is to ensure more effective utilisation of human resources and property. They are carried out against payment [1]. In terms of education, the task of colleges and universities is to provide to students adequate background for their future professions. The basic prerequisite for adequate qualification is the thorough transfer of a broad spectre of theoretical knowledge from various areas related to one's field of study. However, a graduate's qualifications cannot be based solely on their theoretical knowledge. It is necessary to link this knowledge with practical skills. The article is focused on the situation in the area of acquiring practical skills simultaneously with the study at the Faculty of Civil Engineering of the Brno University of Technology. Following the structure of study

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programmes at the Faculty of Civil Engineering is a detailed explanation of the students' option with regard to acquiring practical skills while still in school.

2. Structure of study at the Faculty of Civil Engineering

Brno University of Technology is one of the biggest universities in the Czech Republic. As at 31 October 2011, a total of 23,841 students were enrolled in all programmes offered by eight faculties and two institutes. Of this number, 6,830 students study at the Faculty of Civil Engineering. These students have chosen from among nine accredited bachelor's study programmes, five accredited master's study programmes and six accredited PhD study programmes. They are taught in Czech or English, with full-time or combined mode of study. Seven fields of study are offered within the framework of accredited study programmes:

- Building Constructions
- Building Materials Engineering
- Constructions and Traffic Structures
- Water Management and Water Structures
- Civil Engineering Management
- Realisation of buildings
- Geodesy and cartography

Approximately 370 educators work for the faculty [1].

3. Cooperation with companies as a form of study support

3.1. Mandatory practice as an element of the curriculum

A suitable way to link theoretical knowledge acquired in the course of study with skills necessary for one's professional work on an independent basis is the inclusion of practice in the student's curricula. Students establish contacts with professionals in their respective fields. Thanks to their help and leadership, they can acquire practical knowledge and skills. The benefits of this form of cooperation can be seen on both sides: i.e. students and the cooperating companies. Students establish valuable contacts for their future work; the cooperating legal entities may find and "raise" potential future employees. What makes this solution complicated is that there are not that many companies willing to cooperate with universities and able to provide to students the adequate space for work.

Only one study programme offered by the Faculty of Civil Engineering has the mandatory practice included in its curriculum: it is the master's level of the study programme Civil Engineering, field of study Realisation of buildings. The mandatory practice is scheduled for the summer semester of the first year of the master's level. The mandatory practice spans over ten weeks. It consists in the work at a construction site, combine with site preparation and planning. The goal of this practice is the real-life application of theoretical knowledge acquired in the course of study. In addition, it shall facilitate the students' future career growth.

This model can only be used as long as a certain number of students are accepted into the field of study in question. For the time being the limit is 50 students per class. This is one of the main reasons why the mandatory practice is not included in the curricula of all fields of study at the Faculty of Civil Engineering.

3.2. Internship in companies

Another way to acquire practical experience is via internship programmes for selected students, i.e. on an individual basis. These internships are organised with project-based support, especially through EU-funded projects within the framework of the Education for Competitiveness Operational Programme (ECOP), as well as internal-level projects of the faculty financed by the university. Internships within specific projects are based on the same principle.

Partner companies are invited to take part in specific projects; once they join, they specify their requirements with regard to the student's activities in the course of his or her internship. Subsequently, the university selects the most suitable applicants from among students. Typically, students of the last year of the bachelor's or master's levels are approached. Each student's expertise is taken into consideration. Other criteria may include the grade point average, activity during seminars, motivation, etc. Prior to the commencement of an internship programme a supervisor is appointed for each party: representing the university, it is usually the student's counsellor who supervises the thesis; representing the company is an employee with the relevant expertise. Once the supervisors have been appointed, it is necessary to set the student's goals for the duration of his or her internship. In addition, the length of his or her internship must also be specified (typically, one month or one week). Following the completion of his or her internship, the student shall draw up a final report in which he or she describes the experience and the level of the goals achieved. This document must be endorsed by both internship supervisors.

Compared with the aforementioned option, this activity is much easier in terms of organisation, thanks to the fact that students are treated as individuals. Another advantage is that more students (possibly all students of a certain study programme) can participate, and so can the faculty. The downside is that the demand is inconsistent with the number of internship positions offered by the faculty.

Examples include individual internship programmes within the ECOP project offered at two fields of study (Table 1.):

- field of study Civil Engineering Management
- field of study Water Management and Water Structures

Table 1. Examples of excursions within the ECOP

Field of Study	Civil engineering management	Building construction
Company	Kaláb – developer	Tomáš Dvořák architekti
Responsible p. - company	Ing. Tomáš Kaláb	Ing. Tomáš Dvořák
Responsible p. - faculty	Ing. Gabriela Kocourková	Ing. Jan Pěněčík, Ph.D.
Student	Bc. Kateřina Adamcová	Kateřina Mrkvicová
Time period	one month	one month
Tasks	- research, analysis and evaluation of costs associated with the residential project “Kovářská I” - assistance in the preparation of a cash flow plan for the residential project “Dvorského” - assistance in marketing campaign the purpose of which was to introduce an individual housing development project in Podolí	- information retrieval – building technologies and use of recycled materials in construction - PD administration - preparation of realisation documentation

3.3. Excursions

Another way to present to students the practical realisation of civil engineering projects is to organise excursions to significant buildings and structures. Typically, they are one-day or longer excursions to within the territory of the Czech Republic or abroad. Their aim is to show to students the processes on the site or show them around an existing building or structure of exceptional importance. The excursion is always features an expert commentary by an expert who has something in common with the construction of future operation of the building. The selection of the buildings or structures to be visited reflects the participating students' expertise.

In the field of Civil Engineering Management, excursions are organised every year. The average number of attendees is forty. These excursions are organised by the faculty and students of the PhD study programme at the

Institute of Structural Economics and Management. They are financed thanks to the combination of several resources: the student's own money, the faculty's internal budget or financial resources from EU-funded projects.

Examples include the most recent excursion organised by the Institute of Structural Economics and Management. It was organised for students of the field of study Civil Engineering Management and Water management and Water Structures. It took place in the south-eastern region of the Czech Republic on 11-12 April 2012. The programme of this excursion included visits to the following buildings where the participating students could learn and receive information from professionals in their respective fields:

- excursion to the Education centre of the Faculty of Electrical Engineering and Communication,
- Velehrad – renovation of courtyards and buildings formerly used for farming purposes, inspection of a new service building,
- renovation and construction of water management infrastructure in the Dyje River basin,
- improvement of the quality of water in the Jihlava and Svatka rivers, upstream from the Nové Mlýny reservoir.

4. Other forms of cooperation between the university and companies

Another interesting option with regard to practical experience is the participation in specialised competitions which are focused on particular professional activities. This gives students the opportunity to compare their expertise and skills acquired in the course of their study with the expertise and skills of students from other Czech universities. Examples include the competition “*Rozpočtování s Callidou*” (Budgeting with Callida) focused on knowledge and skills pertinent to budgeting and calculation of construction works. This competition takes place under the auspices of the university and a company specialising in budgeting software. It is held once a year at the university. The students' task is to draw up an itemised budget for a pre-defined construction project with the use of purpose-made budgeting software.

Throughout their study, students have the opportunity to attend and participate in specialised lectures included in the overall curriculum and taught by professionals in the respective industry sector. These experts are often alumni of the Faculty of Civil Engineering who teach the practical application of theoretical topics. They usually have one lecture of a scheduled course to analyse one of the topics on the agenda. These lectures are financed from EU projects or from the university's internal grants.

The university and companies can also cooperate with regard to the students' theses. In this case, a company contacts a particular department of the university (or a specific faculty member), requesting that a specific issue be covered as a topic of a thesis (bachelor's or master's). Students focus and work on assigned topics under the supervision of a faculty member. A consultant also participates; it is usually an employee of the company in question, thereby allowing the company to “raise” a potential future employee.

Of key importance is also the communication between the students and companies with regard to future jobs after graduation. For example, an internet portal project financed from the EPOC programme was launched under the auspices of the RKH Brno, companies can use this portal to offer to students participation in pilot internships focused on specific topics. Analogically, universities may present their options and capacities in the field of research and development and invite students to participate. It is quite common for companies to post job offers, via the respective departments of the university. New employees are often sought by former graduates in the same field of study.

A more recent form of cooperation between students and their university consists in the students' roles as research and development staff: selected students actively participate in research and development projects which are currently dealt with by specific departments of the university.

5. Conclusion

The main task of a university in the area of education is to provide to students a sufficient professional background for their future professions and roles on the labour market. Universities are generally able to provide to

students comprehensive theoretical knowledge. However, they often fail to teach practical skills. However, it is essential that students establish contacts with companies (i.e. practice) while still in school, the main reason being that they need to be prepared as much as possible for specific positions which they will soon be holding in companies.

The article introduces the students' options with regard to acquiring practical experience and skills at the Faculty of Civil Engineering, Brno University of Technology. It would seem that the best solution would be to include practice in the curriculum. Problems associated with this solution are described in this article. Therefore, this solution needs to be combined with any of the aforementioned options, such as internship programmes, excursions or participation in specific projects within the framework of the student's theses.

With regard to the improvement of the situation in the area of practical skills, the faculty may seek inspiration in models implemented by other faculties or universities abroad. As far as Brno University of Technology is concerned, examples include the Faculty of Architecture, where the students are required to have one semester or practice during which they work on their thesis. The Finnish Oulu University of Applied Sciences [2] requires that its students have mandatory practice during their senior year; its success is rewarded with a certain number of credits, otherwise the students cannot graduate. In this case, the students need to find their internship positions in companies themselves, i.e. the practice is not organised by the university, thereby reducing the administrative burden. A different model is in force in Macedonia [3], where bachelor programme graduates must have several years of professional experience before they can sign up for the master's level of study.

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