



CETRA²⁰¹²

2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
Department of Transportation



CETRA²⁰¹²
2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

TITLE

Road and Rail Infrastructure II, Proceedings of the Conference CETRA 2012

EDITED BY

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ISBN

978-953-6272-50-1

PUBLISHED BY

Department of Transportation
Faculty of Civil Engineering
University of Zagreb
Kačićeva 26, 10000 Zagreb, Croatia

DESIGN, LAYOUT & COVER PAGE

minimum d.o.o.
Katarina Zlatec · Matej Korlaet

COPIES

600

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RESEARCH ON COMPETENCES OF STUDENTS OF CIVIL ENGINEERING STUDIES IN THE FIELD OF ROAD CONSTRUCTION

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Abstract

At the Faculty of Civil Engineering Osijek, as in the whole Croatian higher education system, the introduction of learning outcomes and the development of study programmes based on learning outcomes are at the very beginning. Learning outcomes help students, since they clearly describe what is expected from them during the course of their studies. They also help teachers to focus exactly on the desired level of knowledge and skills of students in a particular course. One of the important elements for defining the approach to education based on learning outcomes are data on desirable competences of graduates, which are attained by interviewing employers, graduates, and teachers. The concept of competence includes knowledge, skills and attitude through which an individual is qualified to carry out a particular job. Competence, in that sense, represents a combination of knowledge and its application (skills), attitudes and responsibilities, which reflect the learning outcomes of the educational programme. Replies of interviewed employers should be used for an analysis of the employment process of the Faculty's graduates' and the employers' satisfaction with graduates' acquired knowledge and skills, as well as the possibility to apply them during work. The interview survey should reveal the deficiencies in the educations of students, and which knowledge and skills are missing, according to employers. The employer survey results will be combined with the results of graduate survey. This will serve to improve the organization and content of courses (modules) or the entire programme. In this paper, employers whose activities are primarily in the field of road construction will be interviewed. Also, students of undergraduate and graduate studies will be interviewed in order to determine the perception of the importance of competences, skills and attitudes acquired during the course of their studies.

Keywords: competences, graduate students, learning outcomes, employers

1 Introduction

According to the Communiqué of the Conference of European Ministers Responsible for Higher Education (Draft 2, January 2012) the implementation of learning outcomes and student-centred approach will be the key focus until 2015 [1]. Ministers' ambition is that learning outcomes become a reality of daily student experience as part of student centred learning process. Student-centred approach means that the curriculum is developed based on a set of required competences [2]. For the student, competence means to be able to perform skills and knowledge in order to solve a given problem.

The term competence is used to display a combination of attributes in terms of knowledge and its application, skills, responsibilities and attitudes in an attempt to describe to what extent a person is able to perform them. Definition of competency, which is generally accepted in the countries involved in the Bologna process, is given in a publication of Tuning project Tuning Educational

Structures in Europe, to which competences represents a dynamic combination of knowledge, understanding, skills and abilities [3].

The combination of individual features in terms of knowledge and understanding (theoretical knowledge in the academic field, the capacity for knowledge and understanding), know how to act (practical application of knowledge in certain situations) and knowledge of how to be (values as integral elements of perception and ways of life with others in a social context) allow competent performance and describe the level or degree to which an individual will be able to use them [4]. To develop the student's specific competences it is necessary to determine required knowledge, the necessary skills to apply that knowledge, attitudes needed for subject matter knowledge, methods and procedures which will be achieved, the method of evaluation and achievement of competencies and required instructional media. The starting point for planning the educational process is to determine the competency of graduates (competence based curriculum). In higher education competences are developed in all course units and assessed separately for each level of study programs [5]. Competences are formed in a variety of lessons and achieved at various levels. They can be divided according to subject (specifically to the program of study) and generic competences (common to any degree course) [6].

1.1 Division of competences

The division of competences arose from the need to identify how their acquisition and to facilitate identification (check) of their possession. Tuning project classifies competences into two broad categories: the subject–area related competences and generic or transferable competences.

Subject–area related competencies are crucial for any degree and they are intimately related to specific knowledge of a field of study. They are closely associated with one particular area and are also called academic competence. They form the core curriculum and are included in each training cycle. Professional competences are those relating to the relevant methods and techniques specific to particular disciplines. Professional, theoretical and practical knowledge includes content, factual knowledge about the area, the ways in problem solving, knowledge of area history and contemporary developments.

Generic (general) competences are shared attributes which could be general to any degree. Generic competencies are a set of knowledge, skills and values that are widely used in various fields of activities and allow for adjustments to a variety of highly skilled jobs. Generic or general competencies are becoming increasingly important in preparing students for their future social role. There are three types of general or generic competencies:

- instrumental competences that include:
 - cognitive abilities – capacity to understand and manipulate ideas and thoughts
 - methodological capabilities – capacity to manipulate the environment organizing time and strategies of learning, making decisions or solving problems
 - technological skills – capacity to use of technological devices, computing and information management skills
 - linguistic skills – oral and written communication or knowledge of a second language.
- interpersonal competences – Individual abilities relating to the capacity to express one's own feelings, critical and self–critical abilities. Social skills relating to interpersonal skills or team–work or the expression of social or ethical commitment. These tend to facilitate processes of social interaction and of co–operation
- systemic competences – those skills and abilities concerning whole systems. They suppose a combination of understanding, sensibility and knowledge that allows one to see how the parts of a whole relate and come together. These capacities include the ability to plan changes so as to make improvements in whole systems and to design new systems. Systemic competences require as a base the prior acquisition of instrumental and interpersonal competences.

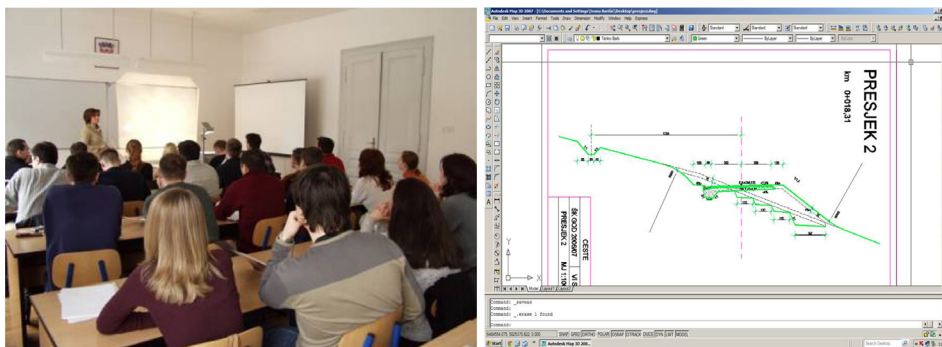


Figure 1 Classroom work: lectures (left) and exercises (right)



Figure 2 Field work and field visits

With the aim of acquiring competencies during the study educational activities can range from lectures (Figure 1.), seminars, research seminars, exercises, laboratory work, guided individual work, independent study, practice, field work (Figure 2.), project work and the like.

2 Competences for the labour market

An important motive for the reform of higher education is to focus on developing graduates' competencies necessary for the labour market. Changes in higher education study program focuses on developing competencies needed labour market and to establish links with the community. Employability of graduates, including self-employment through entrepreneurship, is to be enhanced through continuing adjustments of education programmes and the use of learning outcomes as tools for improved dialogue between higher education institutions (HEI's), students and working life. Higher education must contribute to unlock regional resources, as HEI's are encouraged to work with the widening of local enrolment and the continuous upgrade of the regional workforce. Student-centred learning and life long learning (LLL) must be promoted.

Study program development should take into account an overview of both main EU policies concerning regional policies and higher education and Croatia 2008 Progress Report as well as strategic documents of Eastern Croatian counties. Strategy for the development of the Osječko-baranjska County acknowledges higher education as an important element of social and economic growth; its development is ranked third in importance out of ten key

strategic directives. In the chapter Knowledge is everything the strategy establishes a direct link between education, county level government and economy as a condition for progress and regional competitiveness.

2.1 Construction sector in Eastern Croatia

Civil engineering higher education institutions and construction industry in Croatia currently coexist and function independently. This leads to a gap between competencies of civil engineering graduates and labour market needs. It is necessary to connect higher education and industry sector in Eastern Croatia through a sustainable infrastructure that enables continuous communication, collaboration and mutual impact. This socially responsible partnership in the design and delivery of education should result in higher quality of the engineering profession in the region, giving Eastern Croatia a comparative edge in the construction business. In the last five years, construction market in Eastern Croatia employed almost all civil engineering university graduates offering them a variety of jobs, respected positions and good financial deals. Due to legal restrictions, employers were interested mainly in their diplomas and somewhat less in the quality of their qualifications. But, current global crisis hit the construction sector hard in 2010, forced it to downsize and steeply reduce the number of job offers. So, for the first time, civil engineering graduates encountered unemployment as an option to reckon with. Suddenly, specific knowledge and skills emerged as a highly important element of employability. At the same time, no communication channels were established between higher education institutions and the construction industry so the content of these knowledges and skills was only to be assumed.

3 Students' competences of civil engineering studies

During this period, study programs have been transformed a number of times, mostly due to administrative or organizational changes. First generation of students studying according to the Bologna process enrolled in 2005 following a three level study system. This shift in higher education in Croatia required major study changes, but, although it presented an opportunity to rethink civil engineering education based on learning outcomes, competences, collaboration with employers in the construction industry and other graduates' market options. At the same time employers are not aware of changes due to Bologna process but they are dissatisfied with skills and abilities of recent graduates. There is a silent consensus that employers are not at all involved in the upon employment that they have a broad knowledge of civil engineering matters but that they lack some generic competences and soft skills. In the process of Croatia's accession in the European Union, our graduates' employability is threatened by work force from other European nations.

With the aim of improving academic programs there was a questionnaire based research on the desirable competencies of graduates study civil engineering at the University of Osijek. Research was conducted from the perspective of civil engineering students – which competencies are considered to have achieved during the study and from the standpoint of employers – to evaluate the competency of graduates.

The questionnaire was taken from the project 'Learning outcomes in higher education of civil engineers', which was conducted at the Faculty of Civil Engineering Rijeka in 2010 [7]. The list of competencies that are offered in the questionnaire was based on data downloaded from European Civil Engineering Education and Training (EUCEET) web site networks and criteria of accreditation of engineering study of the American Association for quality assurance of engineering studies (ABET) tailored to the needs of research [7]. Students and employers are assessed through a questionnaire to what extent the study develops specific and general competences.

3.1 Subject–area competences

The research results (Figure 3.) show that students as a least developed competence (score: a lesser extent acquired the partially acquired) emphasize the ability to understand the elements of the construction project and the ability to build complex structures, the ability to identify, define and solve engineering problems and the ability to identify the required additional research and resources needed. As the best–developed competencies, students assessed the ability to apply knowledge in areas relevant to the basic construction, understanding of professional and ethical responsibilities and understanding the needs and readiness for involvement in a program of lifelong learning.

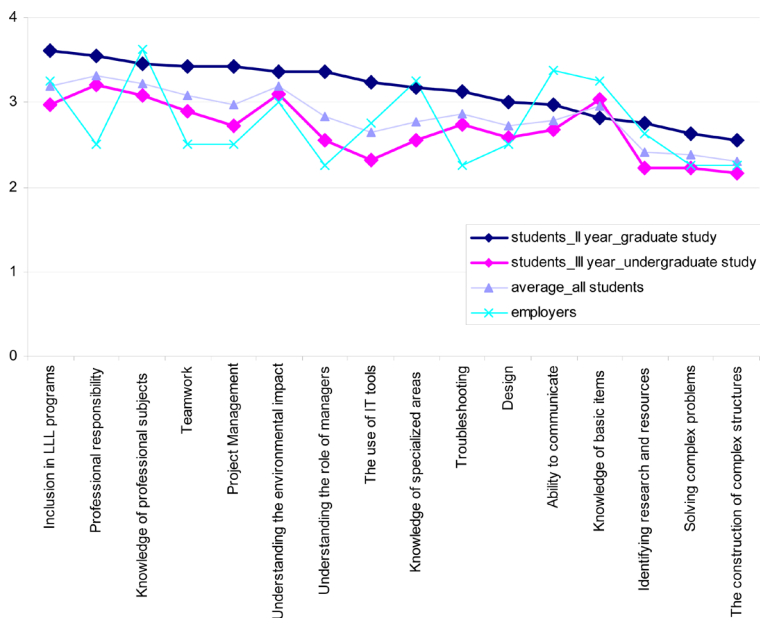


Figure 3 The results of the research assessment of the level competencies that students develop during their studies at the Faculty of Civil Engineering Osijek

3.2 Generic competences

The research results within the Tuning project and the project 'Systematic approach to the introduction of learning outcomes in the education of students at the Josip Juraj Strossmayer University of Osijek' in which the opinions of employers say tested generic or general competence as equally important or even more important for success in business [8]. Nevertheless, the study programs neglect the acquisition of these competencies and their development. Introducing the explicit reference to the acquisition of general competencies in curricula would represent a significant shift towards recognizing and understanding the needs of the labor market for professionals who can easily fit into the different and changing work environments.

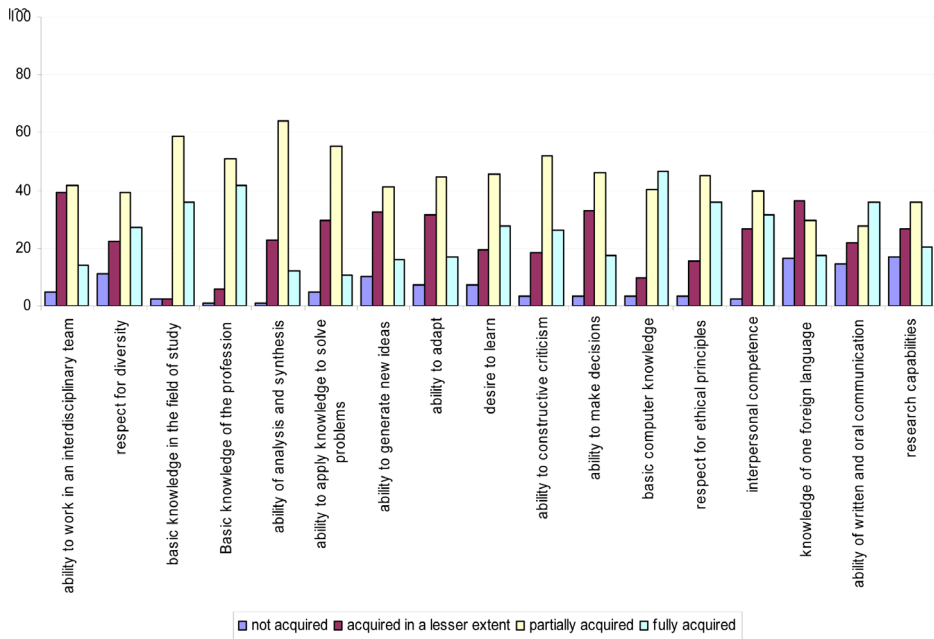


Figure 4 The results of the research assessment of the level competencies that students develop during their studies at the Faculty of Civil Engineering Osijek

The research results (Figure 4.) show that students as a least developed competence during studies emphasize the knowledge of one foreign language, ability to written and oral communication and research capabilities. As partially acquired they evaluated ability of analysis and synthesis, basic knowledge in the field of study and ability to apply knowledge to solve problems.

4 Conclusion

The study found that there are discrepancies in the opinions of employers respect to the students' opinion. Employers generally give better ratings to the students' competences for professional and technical competence that can be explained by a careful recruitment policy, where more attention is paid to the knowledge and skills of candidates, rather than terms such as creativity and knowledge of foreign languages.

It was noted that there are competencies that employers are very highly valued, and that the Faculty of Civil Engineering Osijek has not put enough emphasis in our program. This is the development of generic competence (rational thinking and independence in decision making, ability to select information, the ability of analysis and synthesis) and development of call attitude towards the profession.

The results indicate that the development of academic programs and the acquisition of general competencies should be balanced with the acquisition of professional competence with regard to their importance in employment.

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