

Key competencies of civil engineering faculty graduates in Slovak republic

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Abstract

One of the main tasks of university is to provide an education which supported the expert, as well as the key competencies of graduates. The gained expert competencies are preconditions for the implementation of selected occupations. On the other hand, there is not always a direct correlation between success of graduates in school and their professional life. Moreover, the employers in the construction sector claim that the key competencies – skills and attitudes of person and its readiness for the life quality are very important. The key competencies enable person to continuously update its knowledge and skills needed in practice. The definition and selection of key competencies of university graduates are always influenced by valuable and crucial needs of society. Therefore, we cannot define the key competencies in generally for the university graduates. This paper is focused on the definition of key competencies for graduates of study programme “Technology and Management in Construction” at Civil Engineering Faculties in Slovakia through the processing of various sources – the competence profile of graduates which was defined by teachers of this study programme and by the structured interviews with employers.

1. Introduction

Societal change, the progress of technology and globalisation are accompanied by new challenges which have to be mastered: increasing individualisation and growing societal diversity, accompanied in parallel by expanding economic and cultural uniformity, the availability of a rapidly growing amount of information as well as the necessity to cope with increasing complexity and uncertainties [1, 2]. These conditions require creative and self-organised action, because the complexity of the actors, the action situation and the course of action do not allow for problem-solving processes which go strictly according to plan. Competencies describe the dispositions which individuals need in this environment for acting and self-organisation in various complex contexts and situations [3]. Transformations in recent years at the level of educational paradigms have brought new perspectives on the integration of higher education graduates in the labor market [4].

A goal of Slovak national project “Universities as Engines of development for knowledge society” supported by the structural funds of European Union is the adaptation of university education to the real needs of knowledge society. Within this project was processing the forecast of labor market by 2023 from the point of view of university graduates [4]. Based on the forecast is possible to claim that in 2023 will be a shortage people with university qualifications in the field of construction sectors in labor market. Therefore, Civil Engineering

Faculties have to attempt to upgrade and innovate their curricula and study programmes in order to attract more students and to offer them the education not only in the expert field, but also in the field of key competencies. The key competencies enable the person to continuously update their knowledge and skills applicable in practice. The definition and selection of key competencies of university graduates are always influenced by the needs of society. Therefore, it is not possible to define the key competencies for graduates of all universities in general. The labor market demands a number of key competencies of the current graduates of Civil Engineering Faculties. Based on the requirements of employers, evaluation of teachers and their mutual points were defined the key competencies for study programme "Technology and Management in Construction" (TMC). This study programme was selected as one preferred study programme in Slovakia in terms the requirements of employers. The graduates from study programme TMC is qualified for civil engineering at various levels, for all positions within the technical and production spheres as well as for the engineering-technical positions of the economic sphere, at preparatory departments of investment constructions on behalf of investors, at project departments, at research departments, at the local authority departments, at financial departments and other departments relating directly or indirectly to civil engineering, building preparation, construction project management, construction supervision.

The individual abilities – well cooperation and communication are often more important in work and personal life than the expert skills and knowledge. The schools rather teach knowledge and skills in the field – expert competencies (it is possible to easier to develop, but they are less permanent) than the abilities and attitudes of the person, his preparedness to life quality – key competencies (which are more difficult to develop and measure, but they are more permanent). Therefore, the key competencies are in the centre of interest of all who want to adapt the education system (not only) to needs of the labor market. The importance of their development leading to define of strategic goals not only in the study programs, but also in the field of the employability of particular person [6].

2. Methodology

There were selected five teachers in the study programme Technology and Management in Construction within the solution of national project. Their task was the processing of competency profile of graduate of this study programme through the working meetings, workshops and individual or group work. At the same time, the structured interviews with the employers of graduates of this study programme were realized. The interviews were focused on the identification of graduates' key competencies which are critically important for employers. Subsequently, the documents prepared by teachers and employers has been processed, identified the same (mutual) points or different points of competencies which are developing during the study and the competencies needed for the practice. One of results of the national project is to identification of needed competencies of graduates of study programme Technology and Management in Construction and the selection of competencies that are needed greater develop in the educational process according the employers.

The goal of the selected teachers of the study programme TMC was the creation of competency profile of graduate structured to *expert and key competencies* and identification of critical importance key competencies (necessary for the work performance of graduate).

The field of *key competencies* was divided into two parts - soft skills and hard skills. The teachers identified the critical competencies of graduates of study programme TMC in each part. At the same time, the teachers marked the level of key competencies which are reached by the graduates of study programme TMC. The level of graduates' competencies was divided into 5 grades, where 1 is excellent level, 2 is very good level, 3 is good level, 4 is sufficient level, 5 is insufficient level.

There was created and processed the questionnaire which provided the best possible view of employers to the graduate profile. The employers (respondents of questionnaire) has to define the competency profile (expert a key competencies) of graduate according own preferences and needs. The employers also used the scale from

1 to 5 for the evaluation of current level of graduates, but also for the identification of required level of graduates. The identification of critical important the soft skills and hard skills were necessary in the field of key competencies. The survey was attended by 10 respondents from seven construction companies. The results were processed according the interviews with the representatives of construction companies, as well as according the answers of the structured questionnaires, filled by employers' representatives. Subsequently, the outputs of employers were compared with the outputs of teachers (Tab 1, Tab.2).

Finally, there were identifying eight critical important expert competencies for graduate of study programme Technology and Management in Construction in the point of view the teachers and employers:

- ability to plan and manage, coordinate and supervise the construction projects of buildings, structures and water construction,
- skill in the field of investment management of construction projects,
- skill in the field of the use of automated systems, focusing on the time and cost planning of construction projects,
- ability to work on projects that include problem identification, analysis and implementation of large-scale solutions related to the design and realization of structures interacting with interaction of economic, environmental and social aspects,
- ability to work in a team, lead a team and to plan and coordinate tasks related to construction projects,
- knowledge in the field of technologies for the reconstruction of buildings and the specifics of their preparation and realization,
- knowledge in the field of economic information systems, including the comprehensive controlling management of building production,
- knowledge in the field of integrated management systems of organization and complex management of building projects.

Tab.1 Key competencies (soft skills) of graduates of study programme TMC

| <i>Soft skills</i> | <i>Importance teacher / employer</i> | <i>Required level of graduates from the employers' perspective</i> | <i>Level of graduates in point of view the teachers</i> | <i>Level of graduates in point of view the employers</i> |
|---|--------------------------------------|--|---|--|
| <i>Ability to use of expert knowledge in practice</i> | CI/CI | 2 | 3 | 4 |
| <i>Intellectual performance</i> | U/CI | 2 | 3 | 3 |
| <i>General knowledge and outlook, conceptual thinking</i> | U/CI | 1 | 3 | 3 |
| <i>Ability to identify and solve problems</i> | CI/CI | 1 | 2 | 3 |
| <i>Analytical thinking</i> | CI/U | 2 | 3 | 3 |
| <i>Information management</i> | CI/CI | 2 | 2 | 3 |
| <i>Flexibility</i> | U/CI | 1 | 2 | 2 |
| <i>Dealing with ambiguity</i> | CI/CI | 2 | 3 | 4 |
| <i>Organization and planning, setting of priorities</i> | CI/CI | 1 | 2 | 3 |
| <i>Time management</i> | CI/CI | 1 | 2 | 2 |
| <i>Ability to lead a team, leadership skills</i> | CI/CI | 2 | 3 | 3 |

| | | | | |
|---|-------|---|---|---|
| <i>Bargaining (negotiating) skills</i> | CI/CI | 2 | 2 | 2 |
| <i>Argumentation skills and persuasiveness</i> | CI/U | 2 | 4 | 3 |
| <i>Independence, ability to take responsibility</i> | CI/CI | 2 | 4 | 4 |

CI – critical importance, U – useful

1-excellent, 2-very good, 3-good, 4-sufficient, 5-insufficient

Moreover, the teachers marked as critically important competence “knowledge on optimization and automation of tasks related to all phases of construction projects”. On the other hand, the employers marked the competence “Ecological awareness, environmental protection” as the critically important.

The employers mainly expressed their satisfaction of graduates with the theoretical knowledge in this study programme (expert competencies) during the structured interviews. Therefore, we can claim that study programme Technology and Management in Construction appropriately and properly prepares its graduates in terms of the expert competencies for the practice. The employers positively perceive the mutual collaboration and possibility of the contacts with the future graduates. The employers marked this situation as a suitable opportunity to choose some appropriate further employees.

The field of key competencies was examined in the field of soft skills (Tab.1) and in the field of hard skills (Tab. 2) of graduates in the study programme Technology and Management in Construction. The research has found out the importance, as well as the level of key competencies according the teachers and employers.

The tables provide only these competencies which were identified as critical important by the the teachers or employers. Current, as well as the expected level of given competencies of graduates is expressed as the average value of the values in all structured interviews and questionnaires.

Tab.2 Key competencies (hard skills) of graduates of study programme TMC

| <i>Hard skills</i> | <i>Importance teacher / employer</i> | <i>Required level of graduates from the employers' perspective</i> | <i>Level of graduates in point of view the teachers</i> | <i>Level of graduates in point of view the employers</i> |
|--|--------------------------------------|--|---|--|
| <i>Expert theoretical and methodological knowledge</i> | CI/CI | 2 | 2 | 4 |
| <i>IKT skills / e-skills</i> | CI/CI | 2 | 2 | 2 |
| <i>Ability to think and act economically / economic competence</i> | CI/CI | 2 | 2 | 3 |
| <i>Awareness of the legal and regulatory framework</i> | CI/CI | 3 | 3 | 3 |
| <i>Mathematical skills</i> | U/CI | 2 | 3 | 2 |

CI – critical importance, U – useful

1- excellent, 2-very good, 3-good, 4- sufficient, 5-insufficient

3. Results and discussion

The needed competence profile of the graduate was created based on the internal analysis by the teachers and the requirements of employers’ representatives. The profile obtains the expert (Tab.3) and key competencies (Tab.4, Tab.5), which are critical importance for the graduates to successful work performance.

Tab.3 Professional competences of graduates of study programme TMC

| |
|---|
| <i>Ability to plan and manage, coordinate and supervise the construction projects of buildings, structures and water construction</i> |
| <i>Skill in the field of investment management of construction projects</i> |
| <i>Skill in the field of the use of automated systems, focusing on the time and cost planning of construction projects</i> |
| <i>Ability to work on projects that include problem identification, analysis and implementation of large-scale solutions related to the design and realization of structures interacting with interaction of economic, environmental and social aspects</i> |
| <i>Knowledge in the field of technologies for the reconstruction of buildings and the specifics of their preparation and realization</i> |
| <i>Knowledge in the field of economic information systems, including the comprehensive controlling management of building production</i> |
| <i>Knowledge in the field of integrated management systems of organization and complex management of building projects</i> |
| <i>Ecological awareness, environmental protection</i> |

Tab.4 Key competencies (soft skills) of graduates of study programme TMC

| Soft skills | Description of competence |
|---|---|
| <i>Ability to use of expert knowledge in practice</i> | <i>Ability to integrate gained expert theoretical and methodological knowledge in work performance. This includes the ability to recognize possibilities and limitations of self discipline and take into account the perspective of other disciplines.</i> |
| <i>Intellectual performance</i> | <i>Perspicacity and intelligence, easy coping with the complex problems.</i> |
| <i>General knowledge and outlook, conceptual thinking</i> | <i>The ability to see things in a broader context. Large range of knowledge about business, technology and industry. Broad knowledge, interests and experience, the ability to speak on various aspects and contexts of problems, linking knowledge from different areas.</i> |
| <i>Ability to identify and solve problems</i> | <i>The ability early to detect and proper to indentify the problem, to assess it, to look at it from different point of view, to choose the correct solution, own intention to implement and finish the solution of problem and then evaluate the results.</i> |
| <i>Analytical thinking</i> | <i>The ability to analyze the problem in detail to individual parts, identify weak points and potential threats and problems, identify causal relationships between elements.</i> |
| <i>Information management</i> | <i>The ability to locate, prioritize, evaluate and correctly use the information needed in a given situation. Dissatisfaction with insufficient information.</i> |
| <i>Flexibility</i> | <i>Ability to adapt to changed situations, change or adjust own work habits and behaviour, to work effectively in new or changing situations. Operability and flexibility in thinking, behavior and approach to tasks and situations.</i> |
| <i>Dealing with ambiguity</i> | <i>Dealing with situations when there is not available enough information and when there is no a clear problem and/or solution.</i> |

| | |
|---|---|
| Organization and planning, setting of priorities | <i>Ability to organize sources (people, financial, material and support) of particular task. The ability to divide the work into individual steps, to manage the timetable, to delegate tasks and the verification of results.</i> |
| Time management | <i>The ability to use and organize their time efficiently and effectively, to concentrate on the important things, at the same time do more than others.</i> |
| Ability to lead a team, leadership skills | <i>The ability to motivate the employees, to take the role of leader and to guide them as formal and informal authority.</i> |
| Bargaining (negotiating) skills | <i>The ability to choose the right tactics in negotiating a good time for raising of various topics, ability to achieve during the negotiation the agreement of mutual satisfaction (win-win).</i> |
| Argumentation skills and persuasiveness | <i>The ability to clearly define and communicate the idea, to impress others in order to gain support for their own idea, talk.</i> |
| Independence, ability to take responsibility | <i>Ability to manage the needs arising from the responsibilities, to effectively organize work, to work intently and persistently on the particular tasks and to achieve the necessary result at a deadline without excessive control by superiors.</i> |

Tab.5 Key competencies (hard skills) of graduates of study programme TMC

| Hard skills | Description of competence |
|--|--|
| Expert theoretical and methodological knowledge | <i>Set of expert requirements necessary for the performance of work. They can be relatively easily and clearly measured and verified by theoretical test or practical test.</i> |
| IKT skills / e-skills | <i>General computer skills for routine administrative work (MS Office, e-mail,). It does not include the special computer skills required for positions of programmers (those are reflected in specific professional competence).</i> |
| Ability to think and act economically / economic competence | <i>Knowledge and ability of using of general economic principles and concepts (income, outcome ...). Ability to manage the financial services and products.</i> |
| Awareness of the legal and regulatory framework | <i>Information about the legal system, an overview of the rights and obligations and opportunities, where to go for help.</i> |
| Mathematical skills | <i>The ability to apply the mathematical thinking to solve tasks and problems in everyday life. Skill to perform the mathematical and logical calculations, including spatial (% , volume, area, charts, totals, calculations, simple statistics).</i> |

Based on the analysis of documents prepared and fulfilled by teachers and employers and its mutual comparison (Tab.1, Tab. 2) we can claim that the both sides have almost identical views at the competencies which are critical important for the graduates of study programme Technology and Management in Construction for their successful activities in practice. The employers expressed their satisfaction of expert competencies of graduates. On the other hand, the key competencies – soft skills (Tab. 1) are underdeveloped according their opinion. Considering that the study programme Technology and Management in Construction is one of the preferred study programmes in Slovakia according the labor market, is necessary to implement the innovation of selected study subjects. The innovation has to support the development of the key competencies - soft skills. The list of needed soft skills is given in the competency profile of graduates of the study programme Technology and

Management in Construction based and was created based on the collaboration of teachers of study programme TMC and employers of graduates of this study programmes.

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5. References

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