

Innovations of the Study Program "Management of Technological Processes in Chemistry and Food" According to Requirements of Practice

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Abstract—The aim of the submitted paper is innovations introduced during the engineering study in study program "Management of technological processes in chemistry and food" at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava. However, several technological faculties gradually restrict the entrepreneurial education and economic-managerial subjects due to the lack of students' interest. The paper also includes the results of research since the introduction of the new subject of engineering study at the Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava. In the context of the contribution we used classic research methods such as analysis, synthesis, comparison and qualitative methods in the form of expert interviews with professionals. Proceeding from the last findings it can be stated that a chosen way of the innovative education introduced at the Slovak University of Technology is suitable and effective. However, it is necessary to improve also the promotion of optional subjects and to learn students how to undertake the responsibility for their "graduate's profile" after completing the university study. The article is processed in the framework of the project KEGA "Innovation in Teaching Economic and Managerial Subjects at FCHPT STU in Bratislava".

Keywords—*university education, study program, preparing student, hard skills, soft skills*

I. INTRODUCTION

In Slovakia currently operates 35 universities, 20 publics, 3 state schools and 12 private schools. Higher Education QS World University Rankings 2018 rated more than 4000 universities in the world. The table judges the reputation of the school between academics and employers, the size of the school, according to a number of research outputs, citations in publications and numbers of international students. Three Slovak universities were among the top thousands of universities in the world: Slovak University of Technology in Bratislava, Comenius University in Bratislava (positions of Bratislava's universities were between 751. and 800. partition) Technical University of Košice (positions was belonging to 801. up to 1000. partition) [1].

When choosing a school, the students decided in respect to their future career. The most powerful reasons for the selection of the faculty are expectations that the study will prepare candidates exactly according to needs of labor market in a specific field. Another factor was the fact that passing of the specific program will bring a good reference

for the future. Almost no respondents said they study to be ready for a scientific career.

If the students had the option of repeating the choice, 56.4% of them would choose the same study program at the same school. 32.2% would choose to study on the current university but another field of the study [2].

The research of Center of Educational Management at Comenius University in Bratislava, Faculty of Management, in cooperation with the company Profesia was conducted in the first quarter of 2018 and joined by the students from 33 universities in Slovakia. 5330 of Slovak students of all university levels participated. The survey focused on deciding whether and where to study, on their expectations from the study and their experience with University study.

Among the factors in which the study does not fulfill expectations of students were the organization and management of the study, care about the students, the innovation of the contents and the form of education. Current students would prefer more work-based learning and also more emphasis placed on skills such as communication, teamwork, creativity, or openness to innovation (soft skills), foreign languages, and a readiness to operate in an international environment. A much smaller number of students would like to see more emphasis on the theoretical and methodological training.

According to the survey, respondents perceive the study, in particular, as a good basis for personal development, the option to continue to learn, beneficial for the development of entrepreneurial skills and the potential to be involved in innovation.

If students could change their university training in view of the expectations they have for their careers, they would improve, in particular, the practical and applied elements of training, foreign language and work in an international environment, transferable soft skills and the possibility to combine different objects and create a personalized profile. They would not improve the theoretical and methodological training or transferable hard skills like project management, economics, law, etc. and hard portable skills related to information and communication technologies. If students could define a model of study that would best suit them, the dominant part (more than 70%) would prefer to gain one skill in depth and at the same time an overview of related

skills in order to gain the ability to cooperate between the fields. Only 18% would concentrate on the excellent mastery of one skill, and 10% would prefer the study bringing a general overview and wide range of knowledge and skills in various fields [2].

When choosing a University almost 50% of respondents said speculated about studying abroad (most of them, 45%, eventually remained at one of the universities in Slovakia) [2]. Currently, 15% of high school graduates leave from Slovakia to study at foreign universities.

The current state of the education system in Slovakia does not reflect the needs of employers and the labor market. 32% of people work at the position for secondary school graduates. 53% of university graduates is active in different areas as they studied. Despite the fact that during the study 80% to 90% of them plan to stay and work in their field. "There is a significant mismatch between expectations and the actual situation in the labor market. "This reflects the fact that young people before choosing their educational journey do not have enough information about the application of the graduates and the perspective of the individual." (Branislav Ondruš, Secretary of the Central Office of Labour, Social Affairs Department and Family of the Slovak Republic) [3].

Most grads (54.98%) are looking for work 7-9 months, but unfortunately, not everyone can find it in the same field. Why is that so? Employers most often encounter the problem of inadequate qualifications, practice, but also the lack of self-careers' efforts to build a career during the study. Many students are working during their studies, but often outside of their field of study [4].

Central Office of Labour, Social Affairs and Family of the Slovak Republic submits that universities will offer as many graduates as labor market needs by 2023, thus 20-thousand to 22 thousand per year. The problem is that their education will not be in accordance with the demand. Employment opportunities will arise in particular in the field of industry, namely trade, education, health, transport or construction, where one can expect the lack of experts.

The situation on the labor market is changing significantly. After years of high unemployment, the time has come when especially industrial firms have the problem of finding enough qualified workers. There are many new jobs in the labor market that have to be filled. We observe a significant imbalance between the real need of technically or specifically educated employees in contrast to the interest of young people to study and professionally engage in technical professions in the future [5].

In the year 2012 even 63.2% of businesses introduced a product innovation that was new for the market as well, not only for the company. Such a successful innovators of the process who's in 2012 introduced innovative processes, which was new not only for business but also for the market as a entity were 24.2% of innovating enterprises. The success and significance of innovating enterprises is also evidenced by the fact that although their share in industry and services only 34%, their share in total sales amounted to 66.9% and the total number of employees accounted for 58.3%. It means that the economic importance of enterprises with innovation activity is higher than their frequency and

that these businesses significantly affect the level of the economy [6].

Proving of competence in the labor market after graduating from university is not a simple matter. Just suitably chosen university can fundamentally influence the future career. They should therefore carefully think about where to report and what the chosen field of study will offer in professional life.

Small and medium-sized enterprises (SMEs) represent the dominant form of the business organization in the Slovak Republic. They undertake mainly within the areas of activities and sectors with claims for the workforce. Their competitiveness also depends on the ability of workers to meet the new requirements for skills and qualifications. A key problem for SMEs is a need to improve their innovative capacity. In a view of the limited resources they often have issues not only with attracting young employees and keeping them after completion of the training and education, but also with the integration of the older employees. They must deal with the problems arising from the ageing of the workforce and age-related changes in the structure. In this context, there are important measures, as the increase in the employment rate of women and older employees. For this reason, it is needed to use all available knowledge, skills and qualifications, in order to achieve more flexible qualifications, regardless where and how they have been obtained [7].

The education is a process during which a person acquires and develops new knowledge, skills, abilities and attitudes. Therefore, an educational unit shall be capable to adapt itself to the labour market conditions promptly. importance of the economic education not only of the students and graduates of high technical schools that are expected to function as quality specialists in practice, but also to the significance of an enterprise education. The educational preparation of the technical schools' students and graduates shall flexibly respond to the current necessities of practice. As the education is a permanent process, it is necessary to transfer it into the enterprise education system, as the key factor in increasing labour productivity [8].

II. METHODS AND METHODOLOGY OF THE SEARCH

The paper is elaborated the results of own primary quantitative and qualitative survey conducted in the form the managed interview method. The qualitative part of the research was carried out in the form of In-Depth Interviews (IDI). In the secondary research of the current situation on the labor market, we based on the data of the research-statistical materials of the Ministry of Labor, Social Affairs and Family of the Slovak Republic; the research of Center of Educational Management at Comenius University in Bratislava, Faculty of Management, in cooperation with the company Profesia. The paper also includes the results of research since the introduction of the new subject of engineering study at the Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava. In the context of post processing were used traditional scientific methods such as method of analysis, synthesis, induction, deduction, comparison, observation and

qualitative methods in the form of expert interviews with professionals.

On the basis of the reality and the facts concerning the issues of education we have identified as an important factor the analysis of outcomes that we have formulated into relevant conclusions and recommendations. Factors which motivate students in choosing of their further education have been identified and measures by whose implementation it would be made possible to increase the interest of students in this type of education and from a medium-term standpoint to improve the labour market situation.

III. PROFILE OF STUDY PROGRAM "MANAGEMENT OF TECHNOLOGICAL PROCESSES IN CHEMISTRY AND FOOD" AT THE FACULTY OF CHEMICAL AND FOOD TECHNOLOGY, SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

Evaluation of Academic ranking and rating agency (ARRA); where a total of 112 schools of Slovak universities or mono-faculty schools is evaluated (104 public schools and 8 faculties of private universities in 11 groups of study program). One of the most appreciated technical faculties is Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, Slovakia [9].

The part of this faculty is also engineering degree program "Management of technological processes in chemistry and food" where the subjects are professionally provided by our Department of "Management of chemical and food technology" at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava. In this course, we started to introduce the innovative education in the various subjects. The field of: financial literacy, the teaching of entrepreneurial skills and management simulations.

In Slovakia, there is a growing need for skilled personnel. In this article, we predict how the graduate with the highest employment rate in the labor market should look like. It should be a graduate of a Technical university with English knowledge, ideally suited to a manufacturing company while studying, good theoretical knowledge in the area in which he wants to work. Communicative graduate with economic focus, English and another foreign language, or European B2 and graduate with combined English and German at B2 level [10].

For businesses, it is often difficult to get a new employee with all the professional skills that are needed for the job. Job offers are often changing on the labor market. The share of jobs that require hard skills is greatly reduced.

Hard skills are the professional knowledge and skills. These include, for example, expertise, professional qualifications, blue collar skills, language skills, computer skills, working with technology, accounting, legal skills, etc. Education helps to acquire and improve hard skills. They are recognized by diplomas and certificates which have a great value in the labor market. Hard skills are an integral part of the business requirements of the jobs, i.e. the requirements on competence to carry out certain work of the profession. In general, gaining of higher qualifications or certain professional level skills, gives greater chance of obtaining quality employment.

Soft skills are the skills in the field of human behavior, also known as interpersonal skills. It is the ability of people to communicate, work together, to act, to resolve conflicts, to organize, make decisions, etc. They have a good attitude to emotional intelligence (EQ). These include communication skills, critical thinking, skills in problem solving, creativity, ability to work in a team, negotiating skills, personal management, public speech, time management, conflict resolution, general knowledge, responsibility, empathy, work ethic, coolness or good manners, etc. Soft skills are more required for managerial and business professions, and less important in professional and blue collar professions where vocational skills are more needed. Every person has innate and developed some of the soft skills, abilities and personal characteristics, which make it better or worse to carry out a particular profession. Even if a person does not have innate soft skills (he has no natural talent), it is possible, in the course of life to learn them (obviously with some restrictions). Of course, it requires some training.

Analysis of the working portal Profesia.sk shows, how to see from Fig. 1., that requirements of employers have changed in the last five years. There are still less jobs requiring hard skills. The largest decrease is in economic knowledge, languages and the work with computer. They are replaced by requirements for soft skills such as logical thinking, presentation skills, or work in a team [11]. The students should focus on improving their soft skills during their studies at university.

In 2018, employers required from hard skills only active knowledge of English and German language (English is the most commonly requested knowledge). Businesses are searching not only for theoretical and language experts. Employers put emphasis on logical thinking, presentation skills, ability to work in a team, analytical features and much more. This trend is hand in hand with what we see in the world. At the same time, it is a knowledge that often are not substitutable for automation. The labor market will more and more need creative people with the capability of autonomous decision.

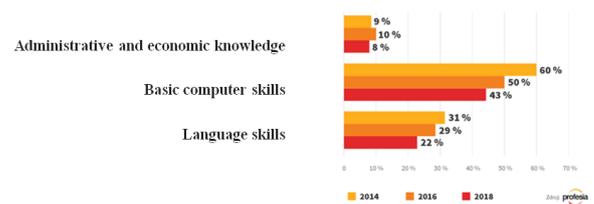


Fig. 1. The comparison of job offers in which employers required a hard skills in year 2014, 2016 and 2018. (source: authors)

The data of Profesia show the most often required soft skills.

- In administration, such as a willingness to learn new things, a responsible approach to work, the ability to work in a team, an active approach to work and communication and organizational skills.
- In Information technologies, it is necessary to have logical and analytical skills, or the ability to quickly learn and flexibility.

- In manufacturing they prefer responsible approach to work, willingness to work, manual skills, logical thinking and the ability to work with the machine.
- In electronics and energetics is required responsible approach to work, a willingness to learn new things, a willingness to work on shifts, the ability to work in a team and manual dexterity.

Profile of study program "Management of technological processes in chemistry and food" at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava graduate contains articles from the fields of Economics and management, which does not require direct practice, however professionally complete the picture with respect to general economic education. As innovation it would be appropriate to include subjects good for gaining presentation and communication skills, especially languages that students currently have as optional or selective.

Analysis of decrease number of students follows that first year of study especially at technical universities is for students critical in terms of their stay or continuing their education at the university. In the academic year 2014/2015 couldn't able to continue the first year of study at the STU in Bratislava average 45 percent of students. Leaders of the university are understandably raises questions about the mentioned adverse condition trying to figure out the cause and adopt measures for its improvement [12].

Table 1 shows an overview of the compulsory and optional subjects offered in the existing course on the engineering study in study program "Management of technological processes in chemistry and food" at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava.

TABLE I. AN OVERVIEW OF THE SUBJECTS TAUGHT ON THE ENGINEERING STUDY IN STUDY PROGRAM "MANAGEMENT OF TECHNOLOGICAL PROCESSES IN CHEMISTRY AND FOOD"

The name of the subject	Type subject
Strategic Control in Technologies	mandatory subject
Budgeting in Technologies	optional subject
Marketing in Industrial Enterprises	optional subject
Financial Market	mandatory subject
Financial Literacy	optional subject
Mathematical Models in Decision-making	mandatory subject
Management of Production and Logistical Processes	mandatory subject
Labour and Industrial Law	optional subject
Tax system	optional subject
Management of Small and Medium-sized Enterprises	mandatory subject
Ethics and Etiquette in Managerial Activity	mandatory subject

Source: Authors

Increase of the attractiveness of higher education should be based more on the cooperation of schools and employers in the preparation of skilled workers according to the needs of the labour market, that of course is the same for education at technical schools, mainly in the field of vocational

subjects from the field of basic economic knowledge and entrepreneurial skills. The advantage of studying the technical directions is that they often tend to be linked with the practice. Students acquire experience in the field.

IV. CONCLUSION

Collaboration of universities with practice is a prerequisite of a modern, high-quality education, leading to the education of graduates, who will be able to find a job in a labor market at home and abroad.

It turns out that not only the students during their studies at all levels of higher education, but also practice requires more cooperation with universities in the present form of the business.

According to students' expectations for future career, they would like to have in their undergraduate preparation more practical and applied learning component and also a greater emphasis on what is called soft transferable skills (communication, teamwork, creativity, openness to innovation), foreign languages, readiness to operate in an international environment and the possibility to combine different items and create individual profile.

If students could define a model of study that would best suit them, they would prefer to gain one skill in depth and at the same time an overview of other, related skills in order to gain the ability to cooperate between the fields.

Graduates of the engineering study programs "Management of technological processes in chemistry and food" at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, were needed in practice, but did not meet the requirements. For this reason, there was an innovation of the study program, so graduates have advantage on the labor market.

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