Influence of Participation in Engineering Competitions on Students' Attractiveness for Future Employer

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Abstract

Nowadays, students need to become attractive for their future employers by developing their soft-skills, gathering certificates, participating in voluntary activities or attending competitions. It is the mission of Board of European Students of Technology (BEST) to allow students to develop in these aspects.

European BEST Engineering Competition (EBEC) is a project that tackles the aforementioned issue. According to the research aiming to disclose the influence engineering competitions have on fulfilling the students' needs of self-development, evaluation forms were filled in by the participants of EBEC from 2010. According to their experience, European students are developing more soft than technical skills when participating in engineering competitions.

This research has proven that participating in engineering competitions is significantly increasing students' non-technical skills required by their future career, as well as their awareness of their importance. This paper contains valuable information for organisers of engineering competitions and bodies involved in the process.

Keywords: students' self-development; engineering competitions; soft-skills; future employer.

1 Introduction

Board of European Students of Technology (BEST) annually conducts European BEST Engineering Competition (EBEC) since 2008. The competition consists of 2 categories: Team Design and Case Study. Team Design is a part where students have to build an invention in order to fulfil all of the following requirements: utility, economy, innovation and level of accomplishing the task required. The second category is called Case Study where participants are solving a case which requires planning skills, analytical thinking, awareness of social and economic issues, abilities to find means to receive a solution and other skills, sometimes dependant on the given topic. The topics are developed in cooperation with industrial partners in order to simulate the working environment and bring forth existing professional issues.

In its 5th edition the project involves more than 6500 students from over 84 European universities. One of the aims of the project is to not only check their technical skills but also to develop by allowing them to apply their academic knowledge into practice. Activities of this kind also raise the awareness of the importance of non-formal education in the process of developing young people. EBEC is connecting all the stakeholders of BEST: universities, students and companies. It is an opportunity to feedback the interaction between aforementioned actors and to emphasise the difference in their requirements from engineering education. Involving different local authorities such as rectors, deans and professors in the project can present a problem based on learning as a solution. This can be used as part of students' learning program. National and regional institutions, such as Polish Federation of Engineering Associations or national government support is also emphasising the importance of such way of learning. As one of the project aims is giving students the possibility to practice the theoretical knowledge gained during the academic courses or by finding new technical solutions for day to day problems that humanity is dealing at the moment with. This paper stresses the need of extracurricular activities during study years and contribution of EBEC in students' soft skills development. The evaluation of the development through participation in European BEST Engineering Competition is presented in this paper.

2 Skills required in engineering

Extra-curricular activities are an added value to study program which some of engineering universities certify in diploma supplement. Conferences, training sessions on soft skills, workshops on career related activities, case studies and engineering competitions are happening all year through on technical universities. The main goal of such events is to develop students on skills that cannot be gained during regular classes. Are those skills needed though?

In his book "Soft Skills: Enhancing Employability: Connecting Campus with Corporate", M.S. Rao calls soft skills as employability skills necessary to start a career. He describes those as behavioural skills, while hard skills are technical. The most important difference is that soft skills do not change with technology innovations as hard skills do. He claims that only one in five recruits possess those referring to recruitment statistics. In the end, soft skills give self-confidence on the way of building a successful professional, private and social life.

In the paper of Australasian Association for Engineering Education authors describe issues of modern engineering to be more complex than ever before. During their work, engineers have to consider not only design, but also environmental, social and economic issues. For instance, they do not present the most gracious solutions, their focus is rather on the optimisation of the design in terms of other currencies such as quality, price and sustainability. Although working environment has changed, education did not, being still "chalk and talk", with the lack of innovative teaching methods. Authors describe several issues of engineering education. Only some of them will be presented for purposes of this paper:

- Engineering curricula are too focused on engineering science and technical courses without providing sufficient integration of these topics or relating them to the industrial practice. Programs are content driven.
- Current programs do not provide sufficient design experiences to students.
- Graduates still lack communication skills and teamwork experience; therefore programs need to incorporate more opportunities for students to develop these.
- Programs need to develop more awareness amongst students of the social, environmental, economic and legal issues that are part of the reality of modern engineering practice.
- Existing faculties lack practical experience, hence are not able to adequately relate theory to practice or provide design experiences. Present promotion systems reward research activities and not practical experience or teaching expertise.

Authors presented solution to those issues in problem-based learning - method originated from medical schools, where students have to solve some tasks and learn through the process.
Other view on engineering market was presented in UNESCO report "The Essential Skills and Attributes of an Engineer: A Comparative Study of Academics, Industry Personnel and Engineering Students". By conducting complex survey among groups mentioned in the title, authors gained a full description of most wanted graduate of engineering faculty. They have described the profile of student by six categories: technical knowledge and skills, intellectual skills, attitudes, standards of engineering practice, business practices, international/national history and culture and proficiency in languages. Figure 1 presents comparison of requirements and importance of each field.

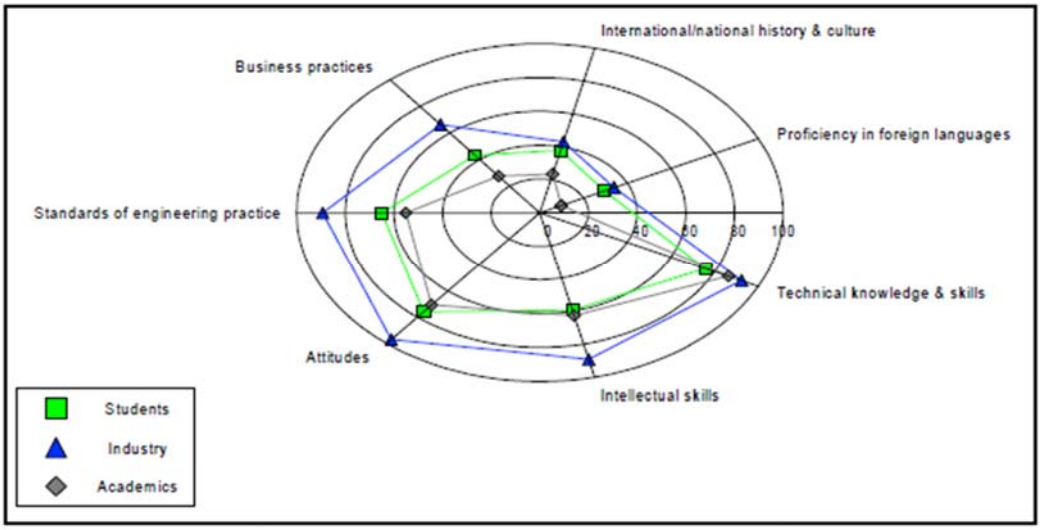

Figure 1: Students' profile description categories ranked by each actor

Every body of engineering education has got different expectations. High demands from industry cannot be fulfilled by regular study programmes. This is, however, not the main outcome of this research. Author has developed a skills chart that may be used to present current engineering skills needs. It is presented on figure 2.

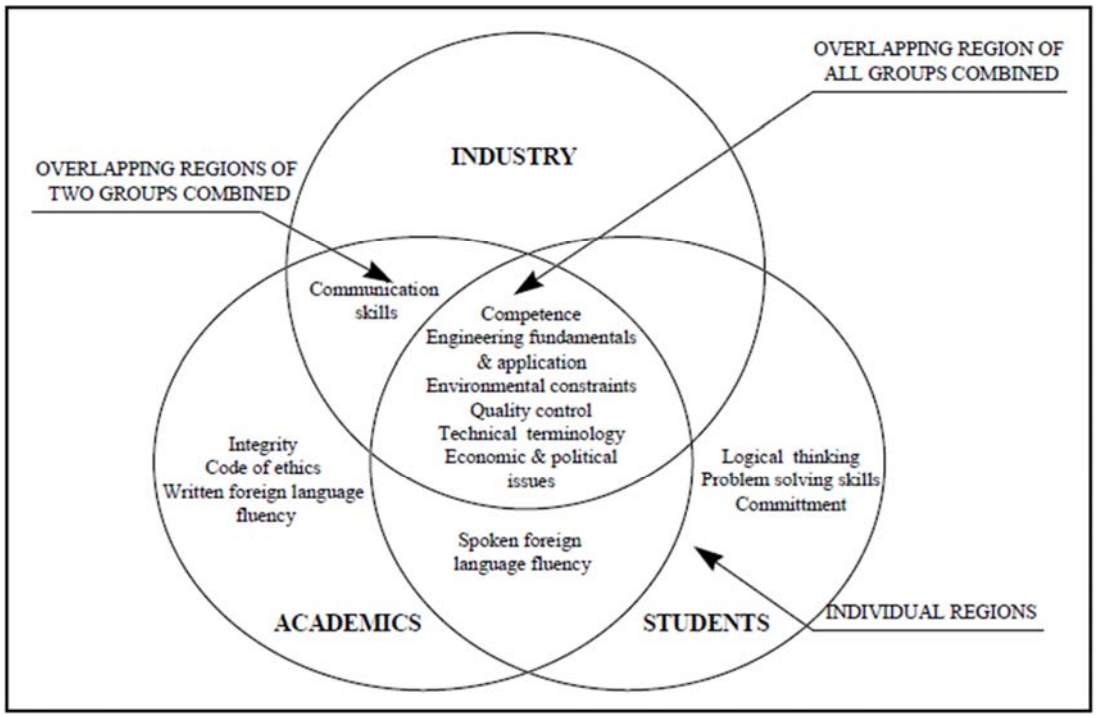

Figure 2: Desired skills in engineering work

There are some skills which all the involved bodies consider important in engineering work, such as engineering fundamentals and application, quality constraints. Some of them, like problem solving skills, are important only for one group. Since industry is where most of engineering students will go in the end of their education, innovative learning should focus on the skills required by future employer. They have described an ideal employee with this phrase: "We require a person with motivation and leadership skills, who is creative, a good team member, risk taking and decisive.".

Researchers have not only found problems but also proposed various solutions. In paper "The future of Engineering Education: III. Developing critical skills" authors describe precisely how to improve skills required in modern engineering. It is proven that the most effective way is to make students learn by practice. Teacher should be a coach then. It means that he should guide students in seeking for answers instead of providing such. By making students present outcomes of their work - teacher force them to reflect about the work they have done. It creates an opportunity to understand more deeply the task and to improve the project during the next phases. Another important aspect for teachers is to grade the whole design process, not only the final product. To evaluate and feedback students' teamwork, leadership, critical management and other crucial skills in modern engineering. Attracting their attention to importance and usefulness of soft skills should profit with increased development in those fields during upcoming projects.

3 EBEC contribution

EBEC in its current shape is organized by BEST since academic year 2008-2009. The competition has been growing and BEST has been establishing higher standards year by year. Improvement measures for EBEC were developed through internal evaluation, but also through evaluation by the participants of the final event of the competition. There is no feedback from participants from the first final event in 2009 Ghent (Belgium), but it was requested in 2010. From 2011 onwards more precise questions about soft skills development of the participants were added to the evaluation form.

Even though there were not many questions asked in the evaluation form from 2010 final in Cluj-Napoca (Romania), some of them might be interesting for this research. The evaluation form of 2010 was filled by 99 finalists of the EBEC project of 2009-2010. Out of their responses 69.7% of participants claimed development of academic skills and 86.6%

of them declared that they have developed soft skills in the project. From its beginning, the project was fulfilling its main purpose - complementary education.

Developing the project further, the evaluation form for participants was also further developed. Realizing everything on what they would like to receive feedback on after the competition, BEST developed a new evaluation form standard. The new evaluation form also addressed skills development of the participants as well their perception of this. These evaluations were filled in by participants of the EBEC final of 2011 Istanbul (Turkey) and 2012 Zagreb (Croatia) and respectively answered by 103 and 91 finalists. Answers regarding skills developed through EBEC are presented in Figure 3 based on evaluations from EBEC final 2011 Istanbul and 2012 Zagreb. The students were asked for each skill to rate their development on a scale of 1-5; 1 – no development at all, 5 – a lot of development. The figure below shows the average result for each skill for EBEC final event 2011 Istanbul and 2012 Zagreb.

What has to be considered is a fact that all the participants of EBEC finals have went through the 3 levels: EBEC Local, National/Regional and Final before they were filling the survey. This makes their answers more valuable in the respect of this paper. For some of them it was even up to 60 hours of working, presenting, discussing, leading, managing and creative thinking. Few steps separated by months or longer time gaps were enough to consider self-development and attitude to this competition. From the chart one can observe that the main skills students have greatly developed were soft skills. Very important is the fact that students have developed almost equally in each target soft skills of EBEC.

Not only the influence of EBEC was evaluated after the final event, but also the reason why do students participate. It may bring valuable answers to the question if students are aware of soft skills development and the ways of doing so. Figure 4 presents the results from the survey conducted after final 2011 Istanbul and 2012 Zagreb. The students were asked what were the main reasons to participate in EBEC. The answers were check-boxes where multiple options were allowed and there was also the possibility to provide an open answer. Figure 4 shows the total amount of answers for each factor of motivation.

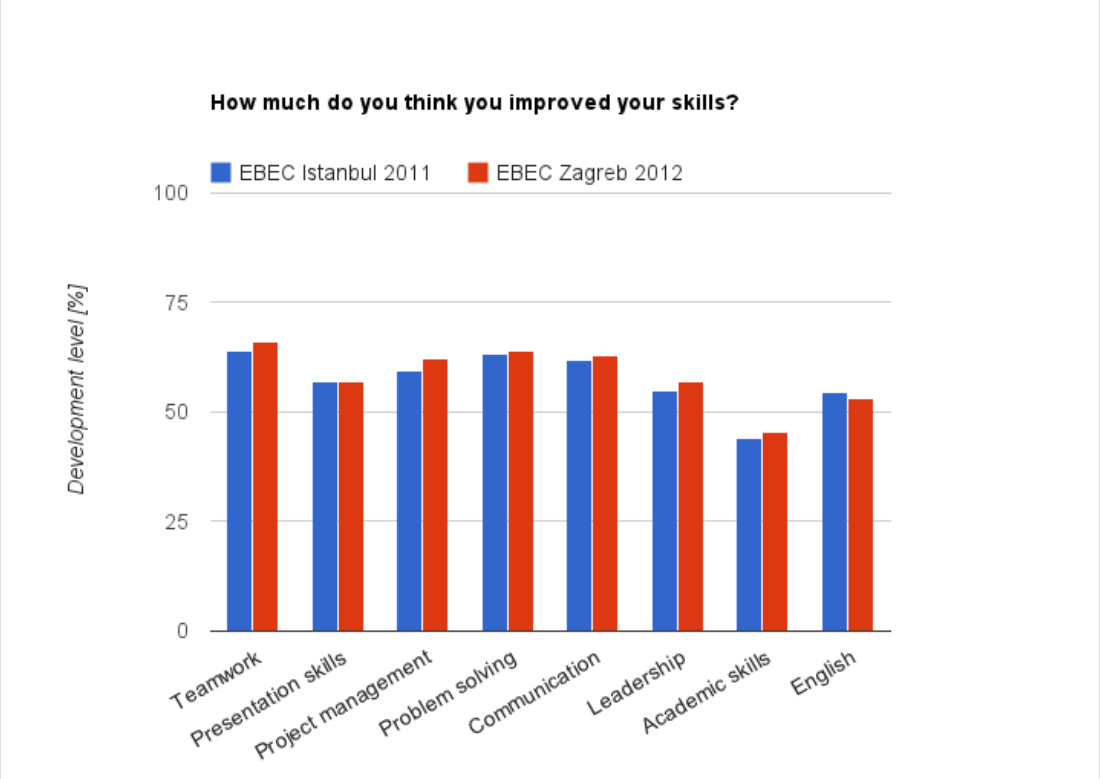

Figure 3: EBEC finals development evaluation outcomes

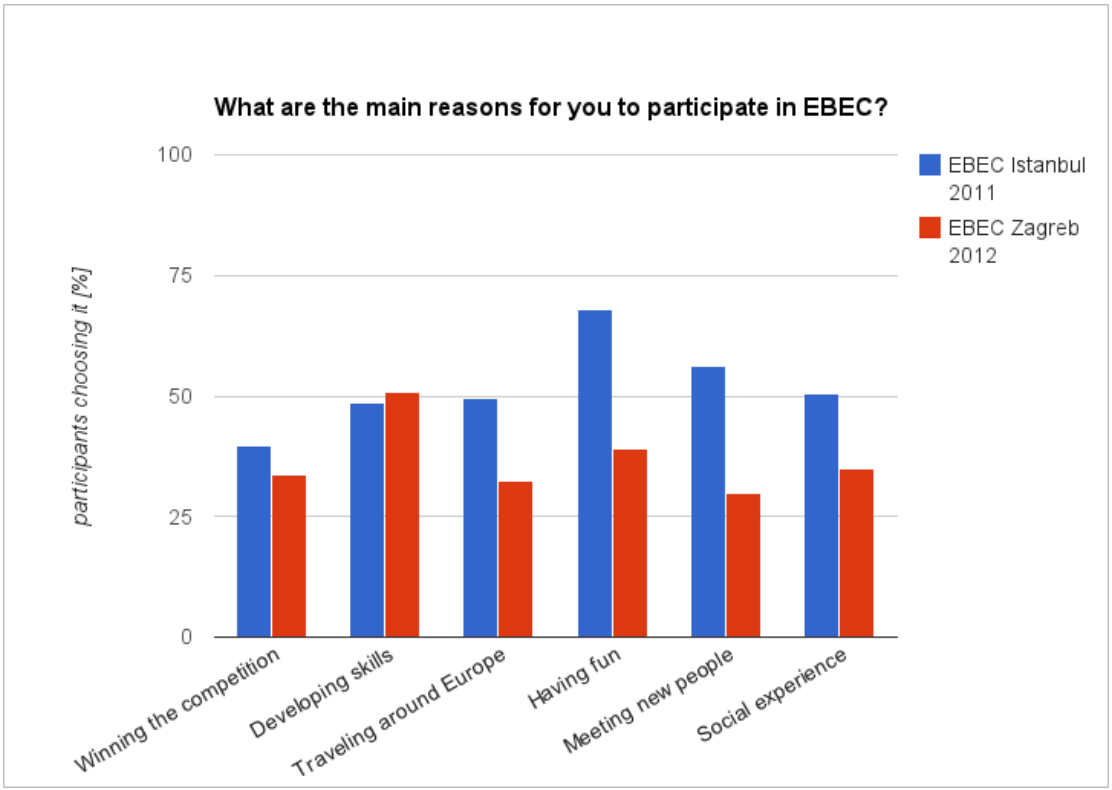

Figure 4: Reasons why did students apply to participate in EBEC project.

As the given histogram shows, the participants see engineering competitions as a way of having fun while solving tasks through participating in EBEC 2011. Meeting new people was next priority, then social experience, travelling around Europe and finally, at 5th position - developing skills. Even though the differences were slight, the purpose of BEST was to attract people to self-development by the project. Next year priorities of participants were totally different. After implementing feedback to promotion campaigns, establishing EBEC as a brand and organising other events with same purpose students started to realise the importance of such knowledge and were considering EBEC as a way to develop in this field. Through the years EBEC gained in visibility and credibility.
A factor describing the success of EBEC can be derived through the willingness to recommend. “Would you recommend EBEC to your friend?” It was graded on a Likert scale 1-10, with 10 - “for sure” and 1 - “not at all”. Average score for both 2011 and 2012 was 8,5.

4 Conclusions

The outcomes of this paper show that the interest of academics, industry and students greatly overlap in the course of EBEC. The skills that are required by the industry are acquired or improved during participation in the engineering competitions. EBEC structure requires students to work in teams. The timing to solve the problem requires them to divide the tasks and plan the work properly. With each stage being more difficult their teamwork, leadership and project management skills improve. Explaining the solution in front of jury is, in many cases, participants’ first public presentation, realising how difficult it can be.

Soft skills are not only improved by participating in engineering competitions. Market research discovered more requirements from the industry. Approach to the cases and tasks in EBEC requires knowledge about environmental, economic and social issues which are not always checked during engineering studies, where it is most important to find the best solution in terms of technological properties. Moreover, the tasks for team design require knowledge from different fields of engineering. Combining them allows solving every problem of modern engineering, as in research and development centres of big companies. During team design students learn by practice. Grading by jury includes the whole process of creating solutions in both categories. Both approaches are also used in project based learning, new way of teaching which brings universities closer to the industry.

EBEC, European Engineering competition is a meeting place of BEST stakeholders: students, universities and companies. It creates an opportunity to raise a dialogue about their requirements from engineering education. It also brings some answers, not only by presenting different ways of reaching and emphasising the importance of soft skills but also by facilitating their interaction. Asking companies to create a task for a Caste Study is a way to present their needs.

In conclusion, the European BEST Engineering Competition can be considered one of the brightest examples of what can be a result when students are able to use their theoretical knowledge in practice. One project connecting 84 universities and over 6500 students from the participating universities can be treated as an important part of European Engineering Education and organisations like BEST, organising such competitions are filling the gap in it. Such influence could be further integrated in engineering programmes around Europe and accredited.

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