
BEST, Academics and Companies Forum

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Abstract - Summary

A "BEST, Academics and Company Forum" (BACo) is a public event of the Board of European Students of Technology (BEST). This kind of event gathers for one week students, academics and representatives from companies in round tables, to discuss topics related to the nowadays challenges in European education on engineering. The goal of the event is to bring together the three stakeholders in education and help them exchange opinions, share experiences, offer suggestions and find solutions to common issues.

This event was introduced by BEST in the light of the dynamic interaction between engineering education and industry. Its aim is to provide a connection and dialogue opportunity to the three stakeholders in the context just described. The conclusions and results of these discussions are then gathered and summed up into reports which present the opinions of the participants and offer hints or proposals on what kind of development and improvement could be made concerning the topic at hand. Such reports are consequently forwarded to the interested stakeholders in education, or directly presented by BEST members in education related conferences around Europe.

BACo 2007, was organised in a beautiful chateau in the south of Brussels by the hosting local BEST group, Brussels, and by the Educational Committee of BEST (EduCo). The main topics of the event were "Undergraduate Research", a project under TREE Thematic Network, and "Services Science, Management and Engineering", a topic brought in the discussion by IBM and its representatives.

BACo Brussels gathered a group of 18 participating students from 14 different countries, all of them studying engineering in different stages, from freshmen to PhD. The participants were prepared for the event, by having them read the topic introductions provided by EduCo before, to ensure that they will participate actively in the discussions.

The outcomes of the working groups will be used to finalise the work of TREE concerning the undergraduate research, also for implementing Service Science in the European engineering education and to raise the awareness about the topic among young technical students.

TREE day – Undergraduate Research

Introduction

Undergraduate Research (UR) is research that is carried out by students during the undergraduate studies in Higher Education Institutes, also known as universities.

Research, in this context, means systematic and active process of inquiry and collecting information about a particular subject in order to discover, revise or interpret facts, events, theories, behaviours or to make practical applications with the help of the information gathered. It can be divided into Basic Research, whose primary objective is the advancement of knowledge and the theoretical understanding of the relations among variables, and Applied Research, whose goal is to solve specific and practical questions.

Undergraduate students, according to the study model described by the Bologna Process (BP), are the ones studying towards a Bachelor .UR is for the first cycle of studies, towards the Bachelor degree. The second cycle of degrees towards the Master of Science degree is not included.

The aim of this discussion day was to give the students an insight to the implementation and the state of development of UR in Europe, to the work being done and to get feedback and new ideas from them. To achieve this the session started with a round-up sharing session. Students shared information about the current situation of UR in their home universities/countries regarding the implementation, the purpose, the funding, the quality and ideas of improving.

Afterwards the discussion continued with the benefits and drawbacks of implementing UR in the universities of the participating students.

The day was concluded with a working session on making new guidelines for implementing UR, starting from the ones already made by TREE until now.

Outcomes from discussion group 1

The day started by asking students about the current situation in their countries to get a general overview of the UR in the different countries.

- **What is the current situation of UR in your own country?**

Russian Federation: So far, there are no Undergraduate Research actions taken. Some times, there are some research activities organised together with faculties and companies, but those have the purpose of analysing the skills of the students, and not to improve the research in the education.

France: Research is something very specialised. There are some research tasks such as documentation, but in general education is like in school and

does not involve research. Students go to lectures, attend courses and have exercises and exams, but not a defined research project. Undergraduate Research is possible, although it is not very popular among students because in undergraduate studies they do not have enough knowledge to make proper quality research.

UK - England: Research is working professionally oriented. There are options to make research studies in companies, especially at master's level, where there is the possibility to make research inside business companies and work in projects. Undergraduate Research is not possible because students of the 1st cycle do not have enough knowledge and are lacking certain necessary skills like creativeness and the will to learn of an engineer, after only two years of studies.

Spain: Undergraduate students do not have real contact with research; they do not really know what it is because research is mostly carried out by the departments of the university, offering the opportunity to do the final project at Master's level. Usually there is a big distance between professors and students, so it is difficult to talk about research if there is lack of communication. There are research opportunities, but they are oriented more to master's level than to undergraduate students. Companies are usually not interested in hiring students to do research.

Serbia: In Serbia, some scientific centres provide research work for undergraduate students and they have the possibility to do some serious research papers. Among other students, they have the possibility to get closer to professors and to get introduced to the research world. The situation for undergraduate research is pretty favourable.

Turkey: There are some opportunities for undergraduate research when students are doing an internship. Since internship is compulsory in every university, it is not seen as a research opportunity by students. Students do not really know what research is. Universities should do more effort showing what research is to students by providing more places to work in the laboratories in order to get a better idea about research opportunities.

After the sharing part, there was a discussion about whether **first cycle students can participate actively in research activities and how this participation could be carried on**. There were several opinions, but in general students agreed that during the first cycle, students are probably not ready to do proper research because they lack some important skills that are only developed after some years of studies.

In order to introduce research in the first cycle and provide the students with the skills they are lacking to be able to make proper research, students could start getting familiar with research by making reviews of existing research papers. Undergraduate students should learn what has been done and think about proper ways to apply it in real life, learn how to analyse, more than try to invent something new. Some suggestions about how to increase participation of undergraduate students to participate in research activities were to assign some mentors from the 2nd cycle to 1st cycle students (current situation in Serbia), that way, 1st cycle students have a closer view about the research that is carried on in higher studies and have a closer relation with people involved in research that could guide them in a closer future. Also they could focus more on applied research and make laboratory projects to students more accessible, in order to understand and learn the research process.

The next topic that was discussed was the **necessity and benefits of Undergraduate Research**. Everybody agreed that undergraduate research was needed in order to have better engineers. The term “better engineers” meant that the students achieved certain skills such as flexibility, creativity and knowledge (learning on the topic), but to reach this purpose, it was needed to study the research process that leads to those skills.

While studying the research process, some more issues related to undergraduate research such as “should undergraduate research be optional or mandatory?” and “should the research be done individually or collectively?” were discussed. One important point everybody agreed upon was the need to assess students’ knowledge. In order to do that, the group concluded that undergraduate research should be mandatory during the last year of studies (similar to master’s thesis, but for undergraduate students) and that there would have to be a mandatory course on learning techniques to analyse research papers and gathering information tools during the first year.

About if the research should be done individually or collective, there was not a consensus in the group. Some had the opinion that it could be more useful to have a group research project to improve team work and learn from the research and the other students. But then there is the problem that companies are more open to take one student to work than the whole group, so it would be more difficult to find a company to support the research project. On the other hand, by doing an individual research project the students get a bigger overview about the whole process and not only just one part. Considering both opinions, students could have some small group research project the second year, and the final year they could have a bigger individual project, when they have already gained some experience in doing research.

- **Providing guidelines to apply UR**

To provide guidelines, there were several opinions and the participants did not reach a consensus, although all of them concluded that there is a need of Undergraduate Research for better engineers. The students were divided into two small groups of 3 people each.

Guidelines proposed by the 1st group

- For the professors
 - Provide projects (topics), explanation of the context, define a task and give well-organised support to students
 - Be available
 - Good communication with students and university
 - Selection criteria for undergraduate research students
 - Assessment of students’ knowledge
 - Evaluation of the research
- For the students
 - Choose department and field of interest.
 - Making links with professors, good communication with them
 - Propose topics of interest to the professors

- Work (collecting data, creating documents, etc)
- Be motivated
- Evaluation of the work done
- Teamwork during the learning process

- For the university
 - Mandatory courses about the process of research work on the undergraduate level.
 - Clear definition of Undergraduate Research
 - Assessment of student's knowledge, recognition
 - Support Undergraduate Research and promote different departments from the university
 - Promotion of research
 - Provide research opportunities to professors and students
 - Good communication and cooperation with companies
 - Funding and support of research

- For the companies
 - Support universities in funding research projects
 - Provide internships for students
 - Suggest research topics of their own interest

Good communication between students, professors, university and companies is essential.

Guidelines proposed by the 2nd group

The second group defined the undergraduate research process in a six months term.

- Students
 - Have an idea, interest for some specific topic
 - Be motivated
 - Research and learning process:
 - Literature review
 - Data research
 - Design and simulations
 - Writing final paper

- Professors
 - Approval of the selected topic
 - Advice/Recommendations
 - Provide data source
 - Corrections of the work
 - Review
 - Good communication with students

- Companies
 - Suggest a research topic they are currently working on

After this six months research process, the students become better engineers, having gained new skills, and it is ready to decide by themselves if they want to stay doing research and studies at the university, or they prefer to work in the industry.

- **How to promote UR? Benefits**

The last topic discussed was about how to promote Undergraduate Research.

- Students
 - Mandatory research activities
 - Respectful diploma
 - Recognition in the degree
 - Future promotions in science
- Professors
 - Higher salaries and bonuses
 - Special trainings
 - Knowledge improvement
- Universities
 - Accreditation
 - Highly demanded graduates
 - Fund raising from companies and government
- Companies
 - Potential employees
 - Fresh look and innovative solutions
 - Opportunity to see the current formation of the potential employees.

Outcomes from discussion group 2

The discussion started with a sharing session. After this round-up students found out about the current situation of UR in other universities or countries and discussed about its implementation, benefits and ways to improve it.

- **What is the current situation of UR in your own country?**

Estonia: There are no guidelines and no system about undergraduate research but on the other hand research institutions and companies are close to the universities so it is up to the student to decide for research in the bachelor degree and find ways of implementing it (support from teachers and funding from companies). The Bologna Process is not implemented yet so undergraduate research is difficult to define and to integrate at the moment.

Romania: Undergraduate research is yet not clearly defined or regulated but is quite familiar for students. Most of the undergraduate research activities are done inside of company programs such as internships and practice periods. Companies see the potential of research for undergraduates and work in cooperation with professors in order to promote it among students and to find proper ways of delivering it.

Macedonia: Research for students in general is quite undeveloped so undergraduate research is out of the question. According to students there are problems with the thesis, which is more and more less scientifically oriented but still a necessity to finish university. Because of the Bologna Process implementation, practice periods in companies are no longer compulsory and even if students take them, companies are not prepared to teach or support students in their research.

Czech Republic: There are only few opportunities for undergraduate research. Although research in the undergraduate level is not very well known, students have the possibility to do research but they have to find their way, a teacher to help and funding from companies.

Spain: Due to no Bologna integration (still in test) undergraduate research is offered by the departments through internships, but there are only few opportunities compared to the number of students willing to do it. Research is mainly done for the final project and regulations for undergraduate research are missing on national level.

Greece: Undergraduate research is not implemented in the curriculum. The possibility of doing UR exist but is not well organised and there are no funds from the university for it. The research in general is funded by the government which leads to little money for it but a more independent research.

After the sharing part, the discussion moved to the issue of funding. Students concluded that there are more advantages if a company provides the resources for research such as money (more than provided by the

university), possibility to use the facilities and laboratories of the company and help from the company's researchers. The only aspect that concerned students was that if the research would be funded by the university/government, then researchers would have more freedom in choosing their research topic and would have a more independent way of working. The idea that non profit organisations and foundations could solve this problem was given by the Belgian professor involved in the discussion and students agreed upon but had no awareness about something similar going on in their countries or universities.

The next topic for debating was the reason and necessity of UR. Despite the fact that none of the students present had any experience with UR, they were very enthusiastic about UR and quite convinced about its utility and necessity. Students thought that UR could help since the beginning of university to decide on the field and specialisation to focus on. Taking a research activity very early in the university studies, can help students decide on their career, not only related to the work field but also the activity performed (engineer, researcher).

Moreover students were in favour of the fact that UR is an excellent teaching and learning method that can be implemented as a project based learning activity. In this case the focus of UR has to be properly set. Generally the purpose of research is getting scientific outcomes but in the particular case of research for undergraduates, seen as a project based learning activity, students suggested that the goal should be pedagogically based.

Students agreed that at the moment in most universities research activity is rather seen as an activity for different/special students (geeks, nerds). This is a fact that should change in order to make UR more popular and easier to approach. To achieve this new image of research among students it was proposed that UR should be implemented from the first year on of university studies, more specifically in the form of compulsory subjects in the curricula concerning research (such as introductory course on research, laboratories with basic research approach).

The problem that students encountered while debating was agreeing on how the curricula for UR and teaching and learning methods should be structured. But the issue was solved by the professor present who concluded that universities promote a variety of learning methods. Giving a lecture can be an efficient way of teaching, in the same way as project based learning can be very useful for assessing and applying knowledge. Learning styles and teaching styles are important and should be varied in order to reach the full potential of a student.

Another keyword of UR that was tackled during the discussion was the selection procedure of the students that want to do UR and it was agreed that the main criteria for selecting should be motivation, skills, grades and prior knowledge in balanced amounts.

Although the students present had no experience with UR, they identified at least theoretically a couple of ways for improving it. Proposals given were: better recognition (ECTS given, curriculum vitae reference, work published in scientific magazines), evaluation of the UR by grades and also in learning outcomes. Another idea that popped up was creating an UR community in universities which would be motivating and stimulating for students. Inside of this community students would communicate easily and would have the possibility to share and help each other. From the expert's

point of view, a way of improving UR is making sure that the process of acquiring knowledge and doing research is properly done and not judging everything in scientific outcomes (a guidance portfolio which would allow constant feedback).

- **Providing guidelines to apply UR**

The foreseen aim of the session was to make students aware of the status of work being done in order to implement UR and to get feedback and new ideas from them.

- For the board of the university
 - starting point:
 - search within themselves to find out activities that are complying to UR but are named in an inappropriate way (projects that contain the topics of a precursor to UR even though they are not seen as such)
 - look for already existing contacts with research centers and institutions
 - clear definition of undergraduate research, common perception upon UR at all university levels, coherence in depth and width, bringing curriculum together in joint courses
 - example of action plan:*
 - 1st year – courses on learning techniques and gathering information tools, screening the information, basic skills students need for research
 - 2nd year – small projects within the university
 - 3rd year – scientific projects that can involve also the corporate level and other institutions
 - working from the very beginning in strong cooperation with teachers (as they are the ones implementing UR) in order to achieve a common goal, working methods and appropriate evaluating procedures (coherence between goals, work, evaluation)
 - the process of UR should be very clear from the beginning, with clearly defined goals and procedures
 - first step could be: international European project
 - study the countries that have already implemented UR
 - Good communication with the professors and the students
 - Common agreement for research topics
 - Find funds for the research (establish good relations with the companies and the financiers)
 - Support the UR
 - Ask professors about topics for UR (which can be proposed by students)
- For the university Professors and Researchers
 - Good communication between students and the management board
 - Provide topics and support projects with different time length and difficulty levels.
 - Establish criteria for the UR selection
- For the Educational Department of the state
 - Fund projects (analyse projects from universities and decide if they are eligible)
 - Participate in the development of the national framework

- For the management of the Industries and the Research Institutes
 - Support (money and logistics) the universities
 - Suggest topics for research
 - Allow students to do research in their labs
 - Provide specialists to help with the UR
 - Provide internships and scholarships for students involved in research

- For the university undergraduate students
 - Participate actively and be motivated
 - Follow the rules/guidelines of the framework
 - Communicate with other students/professors
 - Help others get involved/teamwork
 - Propose topics for UR

Outcomes from discussion group 3

The session started with a small discussion about the current situation of UR in the home universities/countries of the participants attending the event.

- **What is the current situation of UR in your own country?**

Lithuania: UR is not very common. There are some subjects, like Physics or Chemistry that have better chances to be approached as research topic by undergraduates. In the other cases the only thing that resembles to research are some course projects, but they are more like training. The students are not even interested in doing research during their studies. The percentage of students doing research while studying is very low, lower than 1%.

Macedonia: There is no UR. The university doesn't give the students any facility for research. The university doesn't give the students neither moral nor physical support. Most of the time this is due to the lack of money.

Romania: There are some research projects, but many students do not know about them. Most of the times it's up to the teacher to tell the students about some of his projects and select who will do them. Even if you are involved in a research project, the professors don't give the students too much support in continuing this research. So another problem that was raised is how can you find the right professor to help you with the work.

Greece: The closest thing to research are the summer practice programs that school offers. In most of the cases students do not attend them and if they do they don't take them seriously enough.

Hungary: UR is not very developed. If there are any research projects going on, most of the students don't know about it. Even after the implementation of Bologna Process the situation didn't change too much.

Italy: Undergraduate research is offered by the university departments through internships, but there are only few opportunities compared to the number of students willing to do it. Research is mainly done for the final project and thesis.

Further on, the participants discussed about the benefits and drawbacks of UR. The main benefits that they agreed on were that UR helps improving the English knowledge and it involves you more in the topic and the field of study. The development of critical thinking and the networking with people interested in the same topic, were also some benefits pointed out in the discussion. Also UR helps you gain new knowledge and improves research and communication skills.

As for the drawbacks for UR, the participants agreed that if it is not explained properly to students, they might misunderstand it and its outcomes and might get upset. UR also demands a good organisation of the structure and good time management skills, that not many students have.

In the next part of the working session the participants discussed on how they could implement UR in their universities. Some of them considered that UR should be introduced in the curricula and it should be compulsory in order to get accreditation from school for it. In the current situation many people that do research do not have enough time for studying in school in the same time also and fail many of their exams. On the other hand most of the participants agreed that UR should be optional as you need people who are interested, motivated and capable of doing it, not just people that do it because it is in the curricula.

The participants concluded that the more students get involved in UR, the more scientists and researchers are developed within the university. An interesting question popped-up at this moment. This was: what should universities "produce" : scientists and innovators or specialists with engineering skills.

UR should not be like a normal class. People learn better when they get a more realistic problem and they have to search for a solution for themselves.

Students should be more active, so the participants started to think on ways to motivate students to do UR in order to increase the number of students doing it. This is an important issue as it is hard to convince any student to work on something extra-curricular with no credits. For the students it would be easier to join an already active research team, as motivated people are very important. Students can also get motivated if they are sent to a conference to present their work, if they have an article in a newspaper about them, to make them feel that their work is recognised. The connection between the student and the professor is also very important. Professors shouldn't restrict themselves just for giving the list of topics, but also to guide the students, encourage them in their work and help whenever possible.

- **Providing guidelines to apply UR**

- Change curricula to include research projects
 - University management + professors:
 - Develop new courses and assign credits
 - Mandatory course on research methods

- Reward mechanism

- Publication
- Promotion
- Selection for ERASMUS
- Master programme
- Giving credit.

- Intellectual property protection for students
 - Treat Bachelor thesis the same way as PhD dissertation
- Professors mentor programme
 - Professors should act as mentors, providing guidelines and encouragement
- Informal association
 - Suggestion to drop national network from guidelines ?not clear?

- Compensation system for research team
 - Increased funding for teams that take UR
- Promotion campaign
 - Universities should organise seminars, promoting UR, websites, newsletters, advertising campaigns,...

IBM days – Service Science

Introduction

The service sector is becoming increasingly important throughout the developed world, in terms of both the amount of value added and numbers of employees. However, compared with the manufacturing industry, productivity in the service sector is low, and there have been consistent calls for its improvement. Additionally, the future effects of investment in services and the level of future predictability are also low for the service sector. As a result, both service providers and clients are highly dissatisfied with the current assessment and distribution of value that they feel should be attainable through investment in services.

In response to this, a new concept has emerged, centered on IBM's "service science" (now abbreviated as SSME, for services sciences, management, and engineering). The goal of service science is to increase the productivity of the service industry, promote innovation, and create greater validity and transparency when assessing the value of investments in services. Services Science, Management and Engineering (SSME) is a new multi-disciplinary research and academic effort that integrates aspects of established fields such as computer science, operations research, engineering, management sciences, business strategy, social and cognitive sciences, and legal sciences. SSME hopes to bring together ongoing work in all the domains mentioned above in order to develop the skills required in a services-led economy.

During two days, IBM introduced the SSME topic to the students participating in BACo. In the first IBM day the students met some of the key persons in IBM Belgium and found out about the perspective of IBM about innovation in the 21st century, about its business organisation and made the first steps in IBM's world of invention and innovation. After an astonishing experience of the emerging business opportunities, the imagination of the participation was tested with a case study. During the walking dinner that followed fruitful discussions, smiles and prizes were generously found in the presentation room of the castle.

The participants got deeper into Service Science during the second day that was specially dedicated to this topic. After presentations on a big number of domains where SSME can be found or applied in order to achieve improvement, the participants attended a working session in which they shared their opinions on the topic, on the skills of the engineer of the future and on how SSME could help in achieving this.

Outcomes from discussion group 1

The IBM second working session was focused on three main directions. The goal was to get an overall overview of the level of awareness and understanding of service science in the context of the 21st century's economical and social prerequisites.

The three directions were the following: the general perception of students on service science, the skills required in order to be competitive on the labor market and means and ideas for achieving these necessary skills.

The discussion started with stating the general impression that students have on service science as a result of the insight they were given at the IBM Forum. Students agreed that nowadays, we encounter two types of markets, commodities market and services market. Services complement commodities by making them differentiated and competitive on the overall market. An opinion commonly defended is that in the economy we are having today, services are the key point if we consider an economy that is defined as supply & demand and the supply and diversity of goods are higher than the demand.

A surprising question popped up. Thinking that for the last century (19th) high productivity in agriculture and manufacturing were the key points for success and then in the 20th century services had the glory, following question pops up. What comes next? Which is the next challenge, what is there beyond services?

A more personal learning point that students achieved through the IBM session was understanding that the market is the driving force in the world, but considering their own case, our education and mindset are left behind.

After agreeing on the current situation of service science in the context of worldwide economy, we moved on to try to identify the skills necessary for a person to be competitive on the labor market and to match them to the institutions and responsables for education and teaching.

Among the most important skills identified were: ability to think critically, creativity, flexibility, assertiveness, proactiveness, team playing, networking skills, leadership, ambition, presentation skills, professional skills, tolerance, ability to predict, reliability, risk taking attitude, openness to new technologies, competitive spirit and knowledgeable.

After defining the skills the man/woman of tomorrow should have to achieve success in a career nowadays, we tried to see which institutions should teach that person the particular skills we mentioned. A first idea was starting the analytical thinking at early ages by learning and developing from kinder garden on skills such as creativity, competitiveness and tolerance. The discussion moved on to elementary school and second cycle elementary school which were seen by students as a bedrock for building a strong knowledge center and to continue developing all skills mentioned above. At the university level, students expressed their disappointment that there is no communication between the academia and the corporate world (the companies). They felt that almost everything they learnt in university was just food for the thought, just a mind exercise and not what they should know when they enter the world of companies. Therefore they agreed that the initiatives of companies to finance

laboratories and to create special programmes in cooperation with the universities are extremely useful. Other thing that was mentioned was the idea of building student trust in the university and the subjects that are taught but this would happen only if there would be a coherent and safe pass from academia level to corporate level, so that the things learnt in school would be a good prerequisite for a good and successful career.

Outcomes from discussion group 2

The working session started with a brainstorming session about the skills and abilities that students should have in a future job. The participants agreed that the student of the future should have a clear idea about his skills and about the needs and expectations of the companies. This student should also have some basic knowledge in economics and management and presentation and soft skills, even though he is studying engineering. The knowledge of more foreign languages is a must, plus abilities like teamwork and good communication and leadership skills. Concerning the technical part of the student's profile, most of the participants were satisfied by the education they get in their fields of work.

After this small brainstorming session, the participants discussed the points raised in the previous session. The participants concluded that as engineers, besides the technical skills students should have, they also have to be aware of the dynamics of the job market and of the business fields, and also to have some business, economics and management background. These would help the student to find a direction suited to his profile and will help him find the things he should work on in order to become a more valuable future employee. Students should also have an idea about what will be their role in the companies. For example a student should know that management skills don't help you just to become a good manager, they also help you understand how you are being managed and thus better understand the manager's point of view.

The awareness of SSME could form the students' way of thinking, getting them more practical about services, making them to focus on important matters for them and improving their innovation skills.

The participants agreed that this knowledge will help most of the engineering students to find a job and to integrate easier in the job market.

Regarding the technical education engineering students get in Europe, most of the participants in the discussion seemed satisfied by the education they receive. They appreciated the changes implemented due to the Bologna Process as most of their courses were updated and the documentations were renewed.

In order to give the possibility to the students to gain the necessary skills, the participants in the discussion summarised some of the actions that should be taken by the main stakeholders. It was concluded that universities should cooperate more with companies or industry partners in order to be updated with the current demands on the market for engineers and so to improve their educational programs and curriculum. Also as a part of the agreement between the university and the companies, there can be included the obligation of the company to get an amount of students in internships. Another suggestion from the students was that companies

could have a course in the university to prepare the students for the work in the industry, as there are things specific to engineers that are needed to be known by them. Company visits can also be welcomed by the students.

The curriculum should have some changes, too. For this, some optional classes for soft skills can be implemented. But, this way the curriculum could become too big to cover. In order to avoid this, another solution popped up. In some existing classes elements of managerial or soft skills can be included, through different projects and role-playing tasks, that stimulate team-work and communication. Good results can be obtained by changing the evaluation methods.

Regarding the increase of the awareness of students towards service science, different types of presentations, seminars, events with companies could be organised in the universities to promote the concept and to inform people about the current situation in the market. It can also be included in the curriculum of some service science oriented Master Degrees.

Outcomes from discussion group 3

The session started sharing different opinions about the importance of services in order to remind the morning presentations. Students had the opportunity to give their own input about the topic. The main ideas about why services are important were:

- Bring additional value to the products in high competition areas.
- Help you to live better.
- Optimising benefits from a product (1 product – N services)
- Stronger bond is established between companies and customers. Customers get additional value to the product while companies approach to customers' needs.
- Fulfil gaps between engineering and business

Once the importance of services in a closer future was realised, the discussion was moved towards a new topic where students discussed about the skills they might need for their future job or careers.

Some of the most relevant skills discussed were: flexibility/adaptability, emotional intelligence, analytical skills, soft social communication skills (team work, public presentations, etc), open-mindedness, perseverance, responsibility, planning, synthetic mind, understanding other's needs, willingness to provide services and curiosity/willingness to learn more.

Once the list of skills was made, students analysed properly each one of them and discussed which kind of activity or action would be appropriate in order to acquire those skills.

Students concluded the session proposing some guidelines to the university/industry and government, in order to provide the right education to gather the skills that might be needed in a future job or career.

- **Providing guidelines to improve education in the future in order to achieve the appropriate skills**
 - University
 - Seminar courses
 - Students have to prepare a presentation about different topics and they are the lecturer during one session. Some other students are opponents and they have to evaluate and prepare questions related to the topic.
 - Case Studies
 - A real problem is given to the students and they have to solve it in teams, trying to fulfil all the requirements. A public presentation of the solution is required.
 - Engineering Competitions
 - Three categories: team design, case study and debates. Students working in teams have to compete to prove they are the best in the different modalities.
 - Pedagogical competence to the professors
 - Essential to have better understanding of student's needs and capabilities.
 - Promote associations
 - Students have the opportunity to develop some leadership, management and social skills being members of associations.
 - Recognition of extracurricular activities
 - Encourage students to develop themselves doing non-academic related activities.
 - Improve exchange programs
 - Offer broader opportunities.
 - Some course related to sum up scientific/research articles
 - To introduce research at early stages and make students familiar with research papers.
 - Public Speaking
 - Develop presentation skills.
 - Industry
 - Offering real internships
 - Guaranteeing quality (not just photocopies)
 - Paying them
 - Offering seminars/workshops/conferences at the university to approach students.
 - Improve cooperation between companies and educational institutions
 - Funding students associations
 - Supporting students ideas and projects.
 - Scholarship for best students.
 - Offering and funding research projects
 - Government
 - Lower taxes for industry if they offer internships to students.
 - More funding for research.
 - Free higher education.
 - Scholarship for best students.
 - Supporting junior enterprises.
 - Study years counting as full time work.

- Free health care & insurance taxes when offering internship to student

Credits

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