Diversity in cultures and teamwork

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Abstract

European countries have long and strong historical, cultural and educational traditions, which they all want to protect, preserve and defend. Simultaneously, there is a strong wish to join the European Union to cooperate and collaborate, and to develop together in a common cause for a strong competitive EU. International awareness, considerations, courage and concern are extremely important elements to take seriously, if we want to be up front in international business and competition. We have to teach our students what that all means. Students must be involved and learn to identify and develop skills needed to communicate, cooperate and collaborate in groups and environments with people from diverse cultures and different disciplines.
This paper will describe what our students are exposed to, in order to develop the entrepreneurial and soft skills needed, and how we assess the activities involved. It is also a report of nine years of experience with international teamwork in cooperation with and participation of more than 40 universities mainly across Europe. Students from US, Chile, China and Australia are also now joining. All projects, on this international teamwork semester, are real projects done in cooperation with local or foreign companies. We do reach out to industry to develop programmes of mutual interest. Projects are located in the technical engineering areas with supporting wide-range activities including marketing and business. The focus is on the overall realisation process rather than on any specific science or skill. In this way our students are exposed to appropriate activities to value and appreciate diversity. This is recognized to be an important part of the career of the future engineer.

Introduction

More and more companies arrange seminars for employees to discuss their expectations of future employer/employee relationship. The following text is a typical example of what is frequently discussed at management level in international companies:
" How do we ensure sufficient and well-trained managerial, specialist and general personnel to meet the future demands of the organization?" It is a fact that the market is undergoing rapid commercial, cultural and technological development. Changes in society and in family structures require new approaches in human resources management. Job quality and flexibility combined with team spirit and team skills are areas that have developed new meanings. Further, understanding of cross-cultural-business behaviour and concepts are more important than ever. And last but not least autonomous learning and continuing education is essential to develop own potentials. Looking at modern engineering education the required skills base is no longer just technological. It now includes a demand for a person to be proficient with open-ended problem solving and applications. However, the ability to collect, analyze and report large amount of technical, operational and statistical data has become essential. In addition, engineers of today must be able to work in interdisciplinary and international project groups to solve increasingly complex problems.

The modern engineering education

Many observers agree that the present educational format needs to be revised; Educators in college and universities feel the pressure from many sides such as industry, society and students. We have to consider new avenues of learning, teaching and cooperation in order to comply with the demand and desires from interested parties and to cope with the fast developing technology and networking in all areas of modern life.
In trying to do so we are up against problems such as conservatism and inertia in our organisations and among staff. The semester described in this paper is about international teamwork in integrated engineering, which involves inter-related study and work of different disciplines together with appropriate business and technological topics. In this international project semester, known as European Project Semester (EPS), which is located in the Export Engineering department at the Engineering College of Copenhagen, Denmark we long ago chose the project-based learning/teaching method in order to achieve our goals. Through this method we have found that it encourages students to involve themselves and to take responsibility for their own learning. It gives students time and chances to use their acquired knowledge and to find new sources of information. In this way they develop a range of soft and hard professional skills needed, such as teamwork skills and transferable and enabling skills required by the profession. In the text below is described what we consider to-be a good way to perform a project.

A good work process

The following characterize a good work process and a good specialist contribution in the group report that is the product result:

1. The work follows an agreed-upon plan developed by the project group. Its point of departure is an approved problem statement and rules for working together. The group must also have defined the aims and objectives of the project. The plan must involve everyone in the group.
2. The work process must inspire and stimulate the development of both independent specialist skills as well as a collective responsibility towards the project group and the project. The synergy effect prevailing in teamwork[1] of this kind must be made explicit and exploited to the greatest possible extent for the benefit of the work process and the group report. The group itself solves communication and cooperation problems with the help of a third party, if necessary. The group must hold a meeting with the group adviser at least once a week.
3. The result of the international teamwork is evaluated in the work process and the specialist contribution in the group report. The group must be able to document their competence in working together on a major project assignment. Great emphasis is placed on this point. As proof of this, every individual participant in the group must answer the following four questions in writing:

1. What is your specialist contribution to the completed project product (the group report)?
2. What is your opinion of the work process you have been through and how have you contributed to it?
3. What is your social contribution in connection with the performance of the process?
4. What is your opinion of the completed work?

The adviser and the student him- or herself grade the individual group members' contribution to the performance of the project (self and peer assessment) both with regard to the specialist contribution as well as individual contribution to the work process.
The following statements are to be used when grading individual contributions to the performance of the work process:

1. Willingness to build upon the ideas of others.
2. Understanding of the team process.
3. Leadership at appropriate times.
4. Positive attitude.
5. Initiative shown.

The group's adviser gives an overall teamwork grade (TW_L) from his or her knowledge of the work process performed. The group must agree to distribute 100 points among themselves, which indicate how the workload has been in the group that is how each individual in the group has contributed to the completed product and the performance of the process. On the basis of the group's distribution of points, a weight factor, WF, is used to calculate the individual's teamwork grade according to this formula: $TW = TW_L \times WF$.

Project supervision

Supervisors are encouraged to give guidance and help to students in formulating their documentation, but they should under no circumstances undertake any detailed revision or re-writing of documentation. The main function of the supervisor is to provide to the students, on a regular and continuing basis with advice, encouragement and aid in defining, planning, executing and reporting of the project. It is particularly important, however, that, as the project progresses, more self-reliance is gradually invested in the student and in the team. It is necessary for the supervisor to carefully note this process of disengagement and the acceptance of self-responsibility, since this is an assessment criterion.

Assessment

In this section, an outline is given of the methods by which assessment is made and the weightings given to each assessment. Marks are derived from the following sources:

a. Supervisors and external examiners allocate and approve marks from observations of the work process performed (35%) and from the specialist contribution in the group project report submitted (50%).
b. Student oral presentation counts 15% of the total mark.
c. Student teams are asked to create an individual Weighting Factor (WF) to reflect the workload pulled by each member of the team during the project performance. The 100 points distribution mentioned above is decided unanimously.
d. Evaluation of the student participation in the study programme courses after deliberation and discussion with the course lecturer, attendance and from course exercises.

A moderation panel made up of all people involved in other words supervisors and external examiners agrees the final overall mark.

Final examination procedure

The final examination is held as a seminar with the following content:

1. Oral presentation of written report
2. Discussion of professional specialist contents of the report

3. Discussion of the precise communication value of the written report
4. Evaluation of the teamwork (the project process performed)

Student mobility

Since the inception of the European Union funding programmes in 1987 such as ERASMUS, COMETT and TEMPUS and others, the number of students and the range of countries annually involved in international student exchange have increased dramatically. As shown in Table 1 the EPS (European Project Semester) programme reflects this general trend. As seen in the table students from outside Europe have also started to show their interest in this international project semester.
Before year 2000 the course was run once a year thereafter twice a year. For obvious reasons the figures for the year 2003 only show the number of approved participants for the spring semester.

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003
Australia									4
Austria								1	2
Belgium								1	
Chile					1	1			
China								1	1
Croatia									
Denmark	2	1			4	6		11	3
Finland					1	1	4	2	1
France						6	11	9	6
Germany	2	6	2	8	8	6	10	13	9
Holland				7	4	8	13	10	4
Hungary					4	2	2		
Lithuania					2	2	4	2	
Latvia								1	1
Norway						1		2	3
Poland		2	2	11	4	8	6	6	5
Portugal								1	2
Romania								2	
Spain				8	4	7	13	15	6
Sweden				1			2		
Ireland	1							3	
Italy							4		
UK	1	1		6	7	9	4	5	
USA						1	3	3	2
Total	6	10	4	41	39	58	76	88	49
Female %	0	10	25	24	23	36	34	26	24

Table 1 EPS participants

To attract also student from English-speaking countries this programme has partially overcome the lack of British students following engineering courses in Europe by insisting on a lecture programme delivered in English.

Engineering disciplines involved

The programme is designed to give students an overview of the diverse field of engineering. As indicated in Table 2 there is a tendency in many European countries to mix disciplines

such as Engineering, Business and Technology. One example of this is the Danish Export Engineering, four-and-a-half years degree, which also offers languages such as English, German, Spanish and French. Since the project groups are internationally mixed, students learn to appreciate cultural diversity. The main goals of this semester are to familiarise students with the practice of integrated engineering in internationally mixed project groups. These two goals are achieved by providing a set of project-based activities designed to achieve a successful project. Table 2 below shows that several different engineering and technology-based disciplines[2] are involved in organising the international project groups. As the project progresses the differences between each of the technical disciplines begins to disappear. The class begins to extract engineering and starts to recognize the interdisciplinary nature of the operation or of the design solution of the various products.

Export Engineering (a mix of disciplines such as Engineering, Business, Technology and Languages), Civil Engineering, Electronic Engineering, Engineering Design, Integrated Engineering, Information Technology, Industrial Engineering, Mechanical Engineering, Mechatronics, Marketing, Product Design, Quality and Management, Computer Aided Design, Computing & Information Technology, Environmental Engineering, Telecommunication, Production Engineering, Materials Engineering, Industrial Management, Business Administration, Engineering Management, Engineering with Business, Electrical Engineering, International Project Engineering, Engineering Design and Innovation, Biotechnology, Technology and Society, Economics, Computer Science and Management, Logistics Engineering, Multimedia.

Table 2 Subject disciplines involved

Project content and organisation

Every semester we solicit projects from our network in industry where all projects are based. Projects are located in the technical engineering areas with supporting wide range activities including marketing and business. Further, all projects stand in the real world and focus is on the overall realisation process rather than on any specific science or skill. In addition, projects must have deep technical elements, but this does not stop us from doing research projects. We can accept a single-discipline project if it has sufficient breadth and depth. A number of project proposals are worked out together with the companies in question and described in a standard form.

As seen in the Project Proposal Form shown in Figure 1, we indicate the disciplines that we find are relevant and useful on the particular project. All project proposals are then sent to accepted participants whom we ask to return three prioritised choices of their own. They are asked to discuss their choices with their home supervisor.

From this experience students learn what real world engineering is about and what work in an integrated context really means. Each team is involved in defining, systematizing, planning and navigation of their own project. A technical and a business supervisor is allocated to each team. On mandatory weekly meetings things such as project development, teamwork problems, communication and cognitive and political problems are discussed if needed. From these meetings students learn good meeting techniques and disciplined behaviour. Further, they learn the value of a good agenda and to work out good and operational minutes of a meeting. Abilities such as self-confidence, responsibility and communication in English are improved. Also the ability to listen, discuss and negotiate is developed. Company advisers participate in the weekly meeting if their busy timetable allows.

Initial project statements

Anybody can send project proposals to the European Project Semester Secretariat. The specification will be a reasonable detailed description of the work to be done, a breakdown of all skills needed and other relevant information. Projects should preferably be multidisciplinary and from real life. The administration centre circulates details of available projects. The Project Proposal Form, shown in figure 1, describes in one page only the following sections:

1. Introduction
2. Project brief
3. Further
4. Project team
5. Time
6. Areas of study:

   CE = Civil Engineering
   ME = Mechanical Engineering
   PE = Production Engineering
   EE = Export Engineering
   EC = Electronic and Computer Engineering
   EP = Electrical Power Engineering
   Others: such as Chemical Engineering, Environmental Engineering, Biotechnical Engineering, **Marketing, Business** etc.

7. Company:
8. Contact person:
9. Project academic supervisor:

Figure 1 Project Proposal Form

Guidance for performance of projects

Project work involves collective activities in which decision-making should proceed through stages of identification, development, selection and implementation. It is important that, at any given time, each member knows what the other members are doing and why.
In order to meet the aims and objectives of the team-based project, specified in the syllabus, students are advised to adopt the following procedures.

a. Problem identification, project formulation, aims, objectives, tasks to be carried out and specification.
b. Analysis of available knowledge, techniques, constraints and resources.
c. Synthesis of the relevant components of this information to indicate possible routes to the problem
d. Evaluation of possible routes and a decision made upon the optimum route to be adopted (methodology).
e. Production of a planned timetable of goals and milestones to be reached at various stages in the activity in order to meet the problem specification.
f. Execution of the plan with modifications made for obstacles to progress not foreseen at the beginning.
g. Careful documentation of results and evaluation of their importance.
h. Comparison of the results with the initial problem specification and the expected results.

i. Communication of the entire project activity for assessment, in terms of the documentation and presentation requirements.

Project performance/implementation

In each stage of the problem-solving strategy outlined above, there are well-defined tasks that must be performed, skills to be learned, and attitudes to be developed. Furthermore, it is crucial that the work on the project is evenly distributed through the group, so that the standard of assessment can be harmonized.

Student statements

Increasing globalisation requires that our graduates, engineers and other professions must be capable of dealing with unexpected and frequent changes. Besides proficiency they also require training in a broader range of disciplines such as international communication, teamwork and languages. Several years ago we set up the European Project Semester EPS, which is designed to train engineering students and others to work in international teams. To prove the efficacy of this programme a number of typical student statements are revealed in the following.

1. Jeroen Kortooms, Holland. EPS 99
" We, as a group, feel that teamwork plays a vital role in the development and overall success of any project. Within the context of the European Project Semester (EPS), however, teamwork is even more important because of the international nature of each team. New barriers are introduced, such as language difficulties and cultural differences, which need to be overcome early on if progress is to be made and team members are able to work in harmony with each other."

2. Ricardo Reinoso Delgado, Spain. EPS 99
" From the start, the group arranged frequent meetings in order to not only formulate the project but to get to know each other on a professional and social basis. With people from four different countries in the group, it was important to break down the barriers that existed by continually communicating and interacting with each other. These meetings have continued throughout the development of the project and much has been gained from them; we have also ensured that minutes of each meeting have been kept for future reference."

3. Arttu Laitinen, Finland. EPS 99
"I is important that each member of a team not only contributes, but adapts and is ready to accept the ideas of others. The group has concentrated their efforts on getting the most out of each other by assigning tasks that meet the strengths and abilities of the individual. This in turn has led to increased idea generation, which has enabled us to continually improve on the initial project formulation."

4. Mark Paul, United Kingdom. EPS 99
" The Phrase `The whole is greater than the sum of the parts´ eloquently encapsulates the concepts of teamwork. Participation in the European Project Semester encourages understanding, development and an appreciation of many cultures, which together form the basis of progressive teamwork. The group as a whole believe that the European Project Semester also provides the perfect platform with which to build on

the academic and social skills that have previously been learnt and use them within a European context."

5. Rolanas Dauksevicius, Kaunas Technical University, Lithuania. EPS 2000
" I was given the opportunity to participate in EPS 2000. Recollections of that great time are still emerging in front of my eyes. And I am well sure that no EPS will be forgotten by any of the participants no matter how much time passes through. I would like truly to thank you for the hospitality and kindness that has been shown. I am astonished."
"How is it possible to organize everything so well, perfect would be a better word. It is nearly impossible to imagine another place where the benefits and experience gained would be larger, better, more useful. Well, perhaps these words may sound a bit pompous, but I cannot find other ones to express the overall impression. Fantastic, if to be laconic."

6. Andrew Perez, University of Notre Dame, US. EPS 2001
This is the feedback that Mr. Perez sent to his old university: "My name is Andrew Perez and I am a 1999 graduate from Notre Dame with a degree in Mechanical Engineering. Recently I completed a semester of studies in Denmark at the Engineering College of Copenhagen. I would like to take this opportunity to share with you my thoughts on the experience and implore you to consider sending Notre Dame seniors to this program for their final design project." "After working for almost two years as a project manager in Chicago for the Dial Corporation, I learned about the European Project Semester, or EPS, here in Denmark. The details of the program were enough to prompt me to quit my job and move to Denmark to participate."
"In the EPS program, I was faced with team-members who had a different philosophy on the goals of the semester, their school and their lives. We kept different hours and had completely different working habits."
"In the beginning I was literally pulling my hair out in frustration, because never before was I faced with a team of people with such contrary views as my own. Another obstacle was the language barrier. The courses and work for this semester were all in English, but within my group the proficiency level varied immensely. Furthermore I was living in a country that spoke English as a second language. This type of setting puts your patience and your ability to adapt to the ultimate test. For everything becomes a little bit more of a struggle. It took a few weeks before my team and I could get to the point that we were able to even communicate effectively. Outside of the classroom, I enjoyed the classroom of life. Living in a different country poses many challenges, besides the language differences. Danes have a different philosophy about life and what is important, as do most of the Europeans. I had to handle myself in a different way and speak differently (usually more softly!). After five months you learn many things about your culture and why things are the way they are. From this came a better understanding of myself and what I want out of life."

7. Kirsi Törrönen, Helsinki Polytechnic, Finland. EPS 2002
"This autumn 2002 in Copenhagen was definitely the most interesting time of my studies and an unforgettable experience." Working in a team with students from different countries was a good way to develop social and co-operation skills. I also got to know the Danish way of living by staying with Danish people."

8. Nathan Poniatowski, Michigan Technological University, US. EPS 2002
" Participating in European Project Semester, EPS has been a great experience for me. I have enjoyed it thoroughly. I never thought in a million years that I would be studying abroad in Denmark. I was sitting in class at my home university one day when Nick Chope, a graduate student at school told about his EPS experience."
"The term here has taught me a lot of things. I am now more skilled in working in a team. Not only did we have the opportunity to work in teams, but with students from all over the world with different backgrounds. The diversity in the groups made teamwork a bit more challenging, which in the long run was a benefit to all our people skills and teamwork skills. After this term I can say that I understand Europeans more, and that I am much more prepared to work with them in the future if the opportunity arises."
"I am very pleased with the fact that as part of the programme we must give an oral presentation. I think that this is a great skill to have and many times necessary to be successful in business and life. The EPS programme gave all of us the opportunity to experience a new culture. It was especially a good experience for myself being from America. I learned so much about Europe, Europeans and specifically Denmark. This experience has made us more, well-rounded people. With this knowledge of different people, ways of life and experiences we have grown mentally and emotionally. My overall experience here was fantastic. The EPS experience has helped me grow as a student and as a human being."

9. Marianne Riise, University College of Oslo, Norway. EPS 2003 spring semester
" In all my years at university, I have never learnt so much in such a short period of time! Inspiring and involved teachers, interesting subjects, and much focus on the social part- GREAT."

Conclusion

Through the last 16 years we have, through international cooperation, gained very useful background knowledge. We have learned that diversity in cultures accentuates different ways of perceiving, interpreting and understanding things. Each of us has our own paradigm[3] that is frame of reference based upon previous life experience from individual upbringing and cultural backgrounds. Our cultural codes are different. Therefore in cross-cultural and multidisciplinary teams we have to learn to cooperate and collaborate with different mind-sets. Thomas Kuhn introduced in his book *The Structure of Scientific Revolutions* the paradigm shift and showed the significance of first break with tradition, with old ways of thinking, with the old paradigm. This is why it can be very cumbersome but at the same time very challenging to deal with international teams of students. On this course we say that teamwork is group performance with regard to the product produced, the project process executed and the people involved. Group performance is, as we see it, a collective performance of people working on a project as members of an international team. Project work in that sense is social rather than solitary. In doing international teamwork on this course, participants learn what synergy means and they learn to value and appreciate diversity and differences, which is necessary to make a successful group-project. After nine years with this teaching concept we find it inconceivable to contemplate former learning and teaching methods.

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Biography

ARVID ANDERSEN
Following 17 years in Swiss, American and Danish industries Professor Andersen Eur.Ing. MPhil/PhD joined the academic world in 1978. In 1982 he implemented Project -Organized Teaching at his institute. In 1995 he started the European Project Semester (EPS), which is about interdisciplinary and international teamwork. To day Arvid Andersen is director of EPS, now located in the Export Engineering Department at the Engineering College of Copenhagen, Denmark.