MULTIDISCIPLINAIRY TEAMS IN PROJECT-BASED ENGINEERING EDUCATION: AN ADDED VALUE?

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Abstract
In their professional life, engineers often work with colleagues with a different background. By working together in multidisciplinary teams on real life engineering problems during their education, civil and industrial engineering students learn how to benefit from their complementarities. Therefore a cooperation was started between the Engineering Faculty of the Katholieke Universiteit Leuven and two university colleges (Katholieke Hogeschool Brugge-Oostende and Groep T Leuven Hogeschool). This was a very positive experience: the students as well as the staff feel that teamwork and multidisciplinary projects enrich the engineering education.

Keywords: teamwork, multidisciplinary projects, project-based learning, bachelor students

Introduction

The engineer of today has a large scientific knowledge and an analytical reasoning power, he is a team player, eloquent communicator and life-long learner. He works in multidisciplinary teams on open-end projects in various contexts. Therefore engineering education is paying more attention to skills and attitudes like a systematic approach to problem-solving and engineering design, creativity, scientific attitude, communication, project planning and teamwork [1]. Because these objectives are not easily attained by classic lectures, the Engineering Faculty of the Katholieke Universiteit Leuven introduced project-based learning to develop these competencies. All students take the course 'Problem Solving and Engineering Design', that introduces them from the first semester onwards into real engineering practice and teamwork [2]. The concept of this course is to integrate basic principles of the regular courses while working in small groups on design projects. Gradually the students are confronted with technical and social skills.

By broadening the subjects of these design projects and forming multidisciplinary teams, the students can also experience contact with other disciplines. Therefore in Flanders cooperation was started between the Engineering Faculty of the Katholieke Universiteit Leuven -with a five year engineering program- and two university colleges, who have a four year engineering program (Katholieke Hogeschool Brugge-Oostende and Groep T Leuven Hogeschool) [3]. In the Belgian industry, engineers with these two profiles are complementary and work together in teams. Within the framework of this cooperation, civil engineering students and industrial engineering students work together on the same projects. Working in multidisciplinary teams on

real life engineering problems during their education, students learn how to benefit from their differences. Furthermore this cooperation stimulates the entrepreneurship of the future engineers. A good entrepreneur takes initiative, can be a leader, can work in team, communicates and is flexible, plans and organises the tasks, takes into account the economical aspects, can delegate and appreciates complementarity in colleagues.

Multidisciplinary teams

In the academic year 2006-2007 multidisciplinary teams were formed of bachelor students from the Engineering Faculty of the Katholieke Universiteit Leuven (K.U.Leuven), the Katholieke Hogeschool Brugge-Oostende (KHBO) and the Groep T Leuven Hogeschool (Groep T). Three different types of cooperation were implemented:

1. In Leuven mixed teams were formed consisting of three (in the first semester) respectively four (in the second semester) civil engineering students of the K.U.Leuven with three respectively four industrial engineering students of Groep T. Face to face contact was easy and intensive.
2. In the second type of cooperation a Leuven university team of six students gave a subtask to two students of the university college of Ostend, KHBO. Because of the distance (about 140 kilometres) face to face contact was limited.
3. In the third type of cooperation different teams were formed in Leuven (K.U.Leuven) and Ostend (KHBO) who were working on related problems and could exchange information. They only had once face to face contact.

In total 98 students were involved in these multidisciplinary projects. Table 1 gives an overview of all multidisciplinary teams formed in the academic year 2006-2007.

Table 1. Overview of cooperation projects in the academic year 2006-2007.

Semester	1			2
Type of cooperation	Share information	Subtasks	Mixed team	Mixed team
Subject	Wastewater treatment	Solar energy	Hand prosthesis	Small solar vehicle
Civil engineering students	2nd bachelor K.U.Leuven	2nd bachelor K.U.Leuven	2nd bachelor K.U.Leuven	1st bachelor K.U.Leuven
Industrial engineering students	2nd bachelor KHBO	3rd bachelor KHBO	2nd bachelor Groep T	2nd bachelor Groep T
Total number of students	17	8	12	62

Results and discussion

The multidisciplinary projects were evaluated by means of a written questionnaire consisting of a series of closed questions on a common six-point scale (1 = 'I strongly disagree', 6 = 'I strongly agree') and a series of open questions. Based on this feedback, interviews were organised with the students and staff involved in each participating institution.

In total 90 students filled out the questionnaire and 24 students participated in the interviews.

Generally the students respond positively and they feel that this multidisciplinary teamwork enriches their education (figure 1).

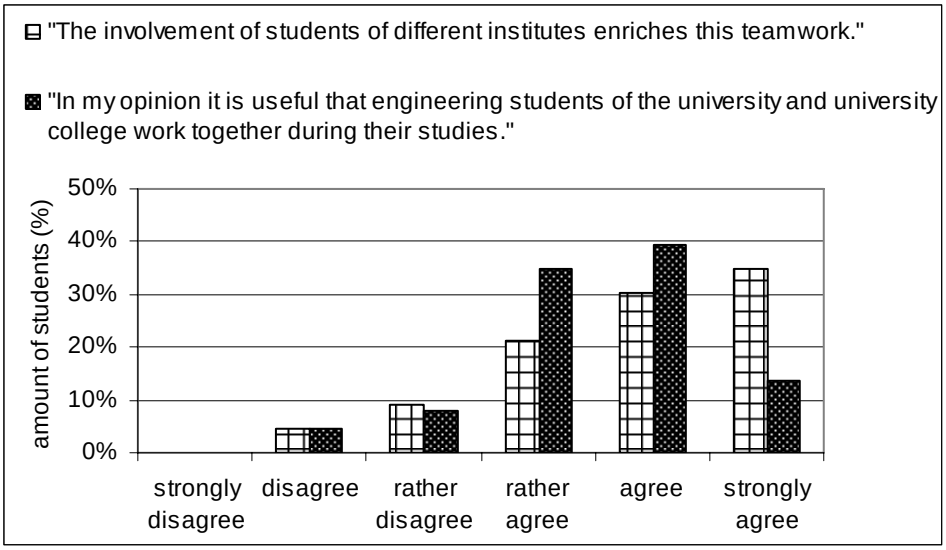

Figure 1. Generally the students respond positively on the multidisciplinary projects.

Working together in these multidisciplinary teams, they recognize the difference between the two curricula (figure 2). Students at the university approach a problem based on their theoretical background, while industrial engineering students are more practically-oriented. This was most pronounced in the second type of cooperation, where two teams of students worked on different subtasks of one bigger project (figure 3).

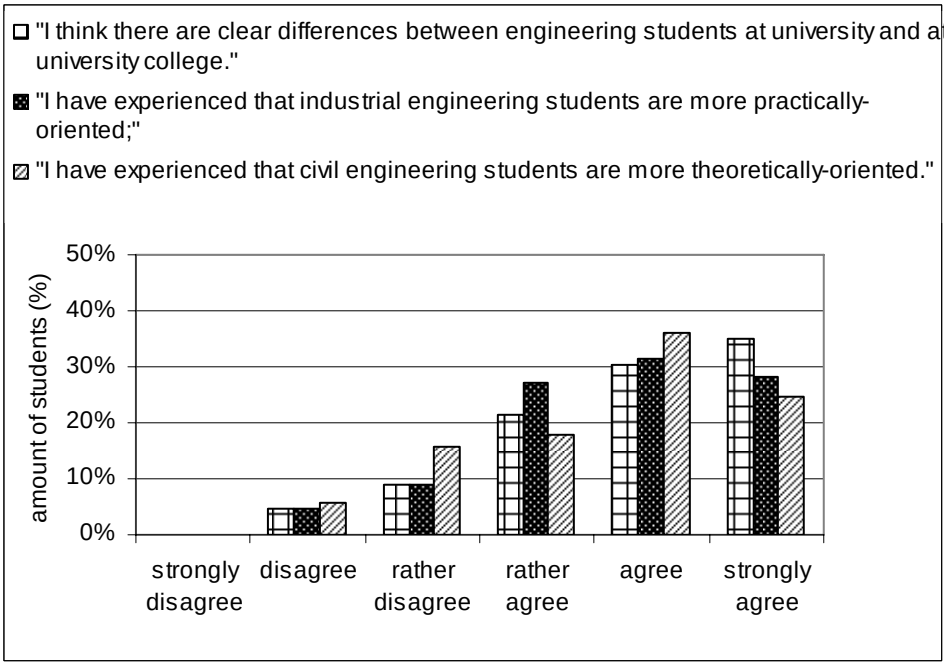

Figure 2. Working together on the same project, the civil and industrial engineering students recognize the difference between their profiles.

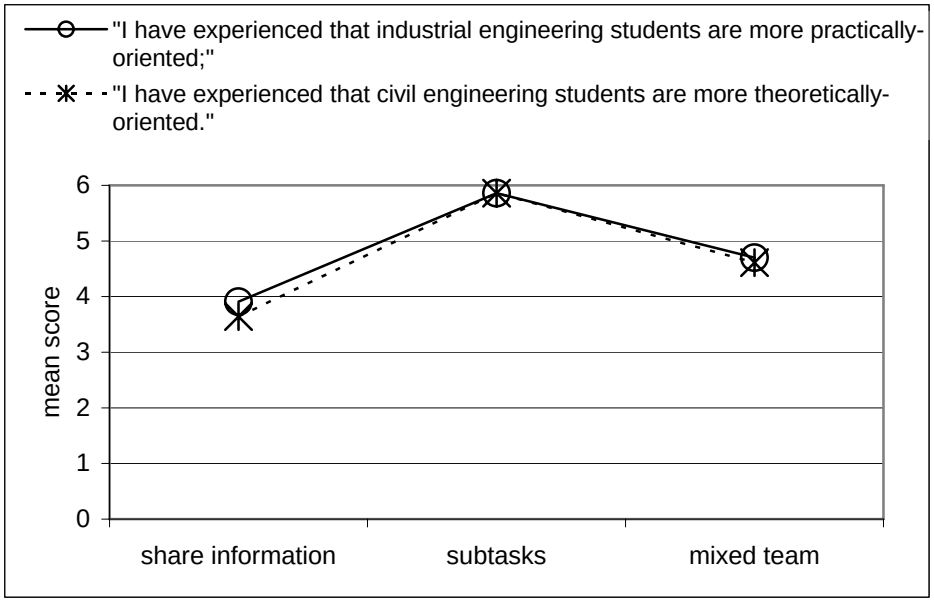

Figure 3. Working together on the same project, the civil and industrial engineering students recognize the difference between their profiles. This was most pronounced in the type of cooperation where two teams of students work on different subtasks of one bigger project.

By means of a series of open questions and during the interviews the students were asked what is in their opinion the most important benefit of this multidisciplinary project and what are the main differences between civil and industrial engineering students. According to the type of cooperation, the students indicate benefiting from the project in a slightly different manner.

1. Students who worked in a mixed team were confronted with the different problem-solving approach of the two groups. Students at the university approach a problem based on their theoretical background, while students at a university college mainly start from an existing technical application and apply trial-and-error more often.
2. The teams who shared sub-tasks comment that they liked working together on a bigger project. They could concentrate on their own strengths and benefit from their complementarities.
3. When the cooperation was focused on information exchange, students appreciated the other point of view. For this type of multidisciplinary teamwork, it is important to choose the subjects well, so each team requires information of the other students to complete their own project.

Main difficulty is the communication with students who are studying in a different institute and therefore have a different time schedule and working place (figure 4). For that reason, even the students working in Leuven in mixed teams found communication difficult.

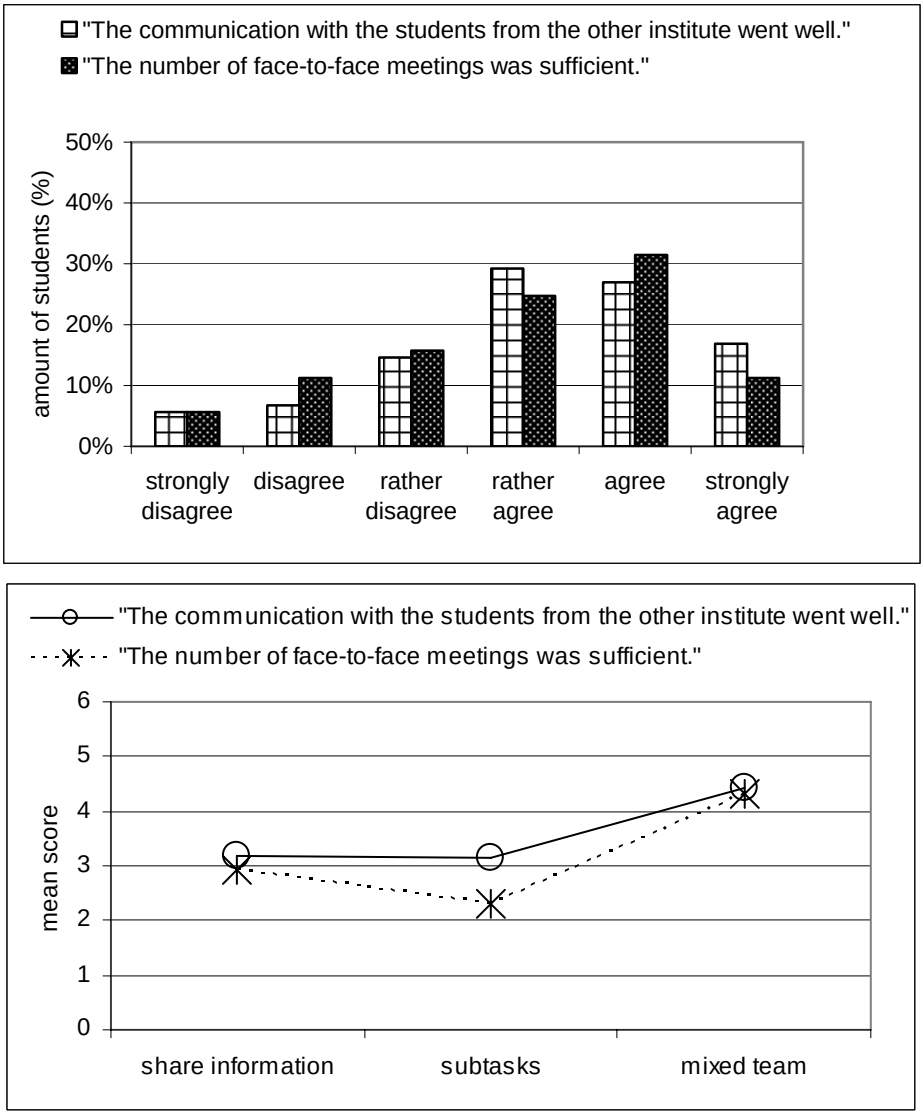

Figure 4. Main difficulty is the communication with students from another institute.

Conclusion

To stimulate the entrepreneurship of the students and simulate their future professional life, multidisciplinary teams were formed where civil engineering students of the Katholieke Universiteit Leuven worked together with industrial engineering students of two university colleges (Katholieke Hogeschool Brugge-Oostende and Groep T Leuven Hogeschool). This was a very positive experience. Through the multidisciplinary project, the students recognize the complementarity of the two curricula. To work together with students from another institute they need to be flexible and take initiative. This however remains a challenge. Bachelor students need more coaching and communication must be scheduled. Because of the complexity of the projects and the number of people involved a central organization is necessary. The subjects for the multidisciplinary projects have to emphasize the complementarities and fit within the existing

curricula. Communication between the students as well as the staff should be organized and scheduled.

Despite of the practical problems and the additional effort needed, all staff involved stresses the added value of forming these multidisciplinary teams in project-based engineering education. This raises the question whether it would be useful to broaden the projects even more towards non-technological areas and disciplines.

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