

# Cooperative work and videoconferencing – Practical tools for engineering studies

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## ABSTRACT

In this communication some work experiences in collaborative environments for engineering studies are presented. Besides, the combined potential for cooperative work and videoconferencing is also shown as an element for quality improvement in teaching methodologies. It is also an approach and simulation of real professional situations. The experiences here shown have been tested in the studies of Industrial Engineering and Aerospace Engineering at the Engineering School for Industrial and Aerospace Engineering of Terrassa (UPC – BarcelonaTECH - ETSEIAT).

**Keywords** : Collaborative environment, Cooperative work, videoconference, webconference, e-portfolio, IT tools.

## I. INTRODUCTION

Problem or Project Based Learning (PBL) as well as Cooperative Work (CW) are educational methodologies that have been winning in importance during the last 50 years. Their presence at Engineering Degrees (Bachelor and Master) is continuously increasing and displacing other classical sessions based on expositive lessons. Results of PBL and CW in terms of quality of learning are usually good [1].

At present, convergence to European Higher Education Area (EHEA) necessarily means transforming traditional teaching models (focused on professor and based on expositive lessons) into advanced learning models (focused on students and based on skills development at the end of their process).

On the other hand, IT evolution brings more and more media and environments to facilitate new learning models and courses. It also allows more efficient information and generated knowledge management. Finally it makes easy for the professors to evaluate the skills achieved by the students (both professional and technical skills).

This paper will show some activities developed at the Engineering School for Industrial and Aerospace Engineering of Terrassa (UPC – BarcelonaTECH - ETSEIAT). Activities are based on collaborative environments and video-webconference in different subjects of the current study plans of industrial engineering and aerospace engineering. Besides, some of the activities that have been designed as pilot tests for the new Degree and Master studies of industrial engineering and aerospace engineering will also be shown.

## II. COLLABORATIVE TOOLS

Among the collaborative tools based on Internet that have gone winning presence in the studies of engineering, we can emphasize some of them:

- Licensed cooperative work environments such as BSCW (*Basic Support for Cooperative Work*).
- Free cooperative work environments, based on wiki, such as *Googledocs* or *Googlesites*.
- Educational Videos, youtube based or through other institutional repositories under Creative Commons (CC) licenses (such as *UPCommons*, a.s.o.).

The evolution of those tools has been changing from simple group documentation managers (focused on documentary quality) to authentic contents and knowledge managers (focused on quality of results) [2].

### A. BSCW tool for PBL in Project Subjects

“*Project*” Subjects are compulsory at ETSEIAT’s Engineering Studies as shown in *Table I*:

TABLE I. “*PROJECT*” SUBJECTS AT ETSEIAT

ENGINEERING STUDY	SUBJECT	YEAR
Aerospace Engineering	Project	4 <sup>th</sup>
Industrial Engineering	Projects Fundamentals	3 <sup>rd</sup>

ENGINEERING STUDY	SUBJECT	YEAR
Industrial Engineering	Project I	4 <sup>th</sup>
Industrial Engineering	Project II	5 <sup>th</sup>
Electronic Engineering	Project	5 <sup>th</sup>
Management Engineering	Project	5 <sup>th</sup>

Engineering projects teaching at ETSEIAT makes use of the advantages and opportunities of PBL (Project Based Learning) [1]. Teaching is given on theoretical aspects applicable to any project field and this knowledge is developed into a practical project, supervised by one tutor assigned to each group

In *Project* subjects, cooperative work methodologies have been developed in order to facilitate the communication inside the groups and the information management. Specifically BSCW environment (*Basic Support for Cooperative Work*) has been used since 2002. BSCW is an appropriate tool for the work in engineering projects, characterized by:

- performing a broadcast of complex information,
- having a high information exchange intensity,
- asking for an adequate management and control of the shared information.

By means of this work environment a folders structure has been generated where all the information utilized by the group, the group agenda, the minutes of the meetings carried out, etc is available. It allows a monitoring of the contributions performed by each one of the components of the group and a synchronous as asynchronous communication among them. Besides, it arranges a set of organization tools that enable the management of the activities for the project development.

The contribution of the collaborative tools has improved the global quality of the projects presented and, besides, has approached students to real professional environments of work.

#### B. ePortfolio Project

The pilot experience of the ePortfolio [3] has been carried out in two subjects of Engineering in Industrial Organization Studies, specifically in *Quantitative Methods* and *Project* subjects. ePortfolio implementation has been carried out through the *GoogleSites* web platform.

The achieved results show that ePortfolio can serve as a complementary evaluation tool through the whole studies duration since permits the evaluation of student skills, both professional and technical ones. It also allows

carrying out the monitoring of their performance, to facilitate and to evaluate the learning process, as well as to integrate it in diverse subjects utilizing a single student owned platform.

#### C. Low cost teaching videos Project

The main objective of the project has been the open diffusion of teaching videos. This project was initiated in the course 2008/09 through a cross study for 25 subjects of the Industrial Engineering, Aerospace Engineering and Engineering in Management Studies, performed at ETSEIAT [4].

Low cost videos require a reduced investment of time for their elaboration, as well as very few resources. This opens a new horizon of possibilities in the reduction of costs, enhancing contents comprehension in the two-sided teaching-learning process.

Produced audiovisual contents were incorporated to YouTube channels of the different members of the study, they were also linked among them and agglutinated into an ETSEIAT YouTube Channel (<http://www.youtube.com/user/upctseiat>) in order to facilitate the finding of contents by means of the search robots.

This methodology of video streaming permits to the faculty to establish new levels of communication with the students, promoting interaction strategies of [4].

### III. VIDEO-WEBCONFERENCE TOOLS

Likewise, during the last years, the growing development and availability of quality videoconferences and webconferences has incorporated new elements of educational innovation that allow new approaches to the process of engineering student's learning. Those facilities, to date were only available at more professional environments than the ones that usually can be found at university classrooms [5].

What can be called as "networked classrooms", taking advantage of the benefits of professional videoconference protocols such as IP H323, or webconference licenses such as WebEx or AdobeConnect or more popular ones like Skype, can be combined with previously explained contents and knowledge managers, offering an horizon of new improvement possibilities in the quality of the studies of engineering [6].

#### A. Experiences and Pilot Plans

Specific experience in videoconferencing will be shown for subjects "Space Propulsion", taught from Massachusetts Institute of Technology (MIT) and "Space Vehicles Design", taught from ETSEIAT using PBL to students located at Terrassa, California Davis University

and in Erasmus mobility (Sweden, Check Republic and Poland).

Pilot plans, designed by the Academic Innovation Area, foresee other videoconferencing–webconferencing possibilities such as:

- Construction Project Management Master – Some lessons and results presentation between Terrassa and Firenze-Torino.

- “Project Management” subjects at Industrial Engineering, Electronic Engineering and Management Engineering – Group sessions addressed to Erasmus mobility students.

- “Project Management” subjects at Aerospace Engineering – Group sessions addressed to Erasmus mobility students and mutual presentation of results with Cranfield University “Aircraft Design Course”.

Preliminary results of specific experiences have been considered very positive by the students and professors participating in them, thus encouraging at a wider exploration of possibilities in different pilot plans that will be envisaged during 2011.

### *B. Spatial Propulsion*

"*Spatial Propulsion*" Subject is an optional 5th course of the Spatial Engineering intensification. Theory sessions are developed from the *Massachusetts Institute of Technology* (MIT) by means of videoconferencing. This subject has been taught in the courses 2008-2009 and 2009-2010, with excellent results of appraisal, satisfaction and skills development by the students.

Videoconferencing has been used in the theory sessions (with about 10 to 15 students) and, during the first year of teaching, they were developed weekly at the early afternoon (Spanish time). The second year of teaching continued with a similar approach; nevertheless, the professor giving the subject could come during some weeks to ETSEIAT classrooms and, as a result of it, the total number of videoconferences was reduced.

### *C. Spacecraft Design*

"*Spacecraft Design*" (DVE) is an assembly of two optional subjects of 5th course of the Spatial Engineering intensification. The practical sessions are jointly developed with students of the California Davis University.

The first time that the subject was conducted, during the 2008-2009 academic year, the study group developed a exploration mission project of the Venus surface by means of one balloon.

In this second edition (academic year 2009-2010) the project has been performed by an assembly of ETSEIAT students and another group of students of the California Davis University, with similar characteristics as for know-how and subjects studied. The group was completed by three ETSEIAT students in Erasmus mobility Erasmus in Poland, Czech Republic and Sweden [7].

This new videoconferencing experience has allowed identifying new synchronous and globalized work possibilities for projects group, and they have been included into the Videoconferences Development Plan at the ETSEIAT.

## CONCLUSIONS

ETSEIAT has been extending the use of IT tools in order to improve the quality of the learning in the engineering studies performed in it.

Thanks to different department and cross-department initiatives, other IT tools for the collaborative work, the in-class and out-of-the-class learning processes have also been gradually introduced. Such tools have set new quality standards for the development of subjects in the studies of engineering.

At present, the Videoconferences Development Plan at the ETSEIAT enhances the spatial horizon of work, especially whit groups of students working in PBL.

Although specific conclusions can be very incipient, the prospective after the first experiences are very encouraging.

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