A Multidisciplinary Problem Based Learning Experience for Telecommunications Students

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ABSTRACT

The Telecommunications Engineering degree contains the study and understanding of a wide range of knowledge areas, like signal theory and communications, computer networks, and radio propagation. This diversity makes it hard for students to integrate different concepts, which is essential to tackle real and practical problems that involve different subjects. As a response to this need of integration, a group of professors at Rey Juan Carlos University carried out an educational project based on Problem Based Learning (PBL), called the Wireles4x4 Project. In this project, groups of students build a complete system to autonomously drive a radio controlled car, involving different technologies such as wireless communications, positioning systems, power management, and system integration. The results show that the participating students improve not only their specific knowledge on the involved issues, but also their capability of integrating different subjects of the degree and the skills for autonomous learning.

Keywords: Concept Integration, Multidisciplinary Learning, Problem Based Learning, Professional Capabilities Training, Telecommunication Engineering

INTRODUCTION

The Wireless4x4 project is an annual educative project developed by students and educators at Rey Juan Carlos University, in Fuenlabrada, Spain. Specifically, the participants of this learning experience are members of the Telecommunication Faculty (ETSIT, from its Spanish name Escuela Técnica Superior de Ingeniería de Telecomunicación), in which three five-years degrees and one six-years degree are offered, all of them closely related with information technologies. Since 2009, four new four-years degrees adapted to the European Higher Education Area (EHEA) are progressively substituting the rest of the degrees.

Each of these degrees contains the study of a wide variety of knowledge areas, like signal theory, communications theory and practice, electromagnetic fields and radio propagation, computer networks, data processing, programming fundamentals or electronic design. With the classical teaching methodologies, and due to the difficulty of the engineering topics, very often the students become bored and get discouraged about their learning process (Felder & Silverman, 1988). In fact, the adaptation of the degrees to the EHEA implies not only a change in the structure and number of the courses, but also a change in the learning methodology used in each course (Cuinas & de-Lorenzo, 2010).

Throughout the five years of the degree, the students follow a plethora of different courses, which sometimes are not conceptually connected. Therefore, it is often hard for the students to integrate all this knowledge and skills, which is an essential capability that a telecommunication engineer is expected to apply in his professional career (Colomo-Palacios, 2010). Several novel methodologies have been proposed in order to improve the learning capabilities of the students in a particular area of knowledge. For example, in software engineering, different techniques such as dropped analogies and self role plays have been applied to make the concepts easier to understand by the students (Matsuo & Fujimoto, 2010; Carbonell

et al., 1983; Casado-Lumbreras et al., 2009). Also, Hrad and Zeman (2010) make a general description of the situation and provide some examples of interesting learning activities in the area of electrical communications.

However, only a few numbers of works face the complex task of providing an integrating multidisciplinary education methodology in electrical engineering. In Campo et al. (2006) the authors describe a multidisplinary activity which involves technical skills learning (electronic instrumentation) together with business administration capabilities (market surveys, enterprise creation…). In Klobas et al. (2004) a learning object is proposed to facilitate the dialog between abstract knowledge and application in specific context, both in business and engineering areas. Some works (Martínez et al., 2010; Maskell & Grabau, 1998) also propose to use of Problem Based Learning (PBL) techniques as a practical tool for multidisciplinary learning projects.

Moreover, the professional market requires engineers that not only manage different technical knowledge and skills, but are also used to face with real problems with real constraints, and are able to work in teams, organize a long-term work and make public presentation of their results with clarity and determination. All of these professional skills are hardly acquired with the classical learning methodology (Woods et al., 2000).

Therefore, the Wireless4x4 project is an innovative learning experience, based on Problem Based Learning (PBL) techniques (Albanese & Mitchell, 1993), which represents an effort of Rey Juan Carlos University to overcome these limitations of the classical educative procedures. Then, the main objectives of the project are:

- The development of an active learning methodology, by which the students acquire integrated knowledge and skills on a variety of subjects.
- The acquisition of professional skills like teamwork capabilities, oral and written communication, and long term task scheduling.

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