Chapter 4
Industrial Training in Engineering Education in Spain

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ABSTRACT

Practical training in companies has been recognized for many years as an important component of the education of new engineering graduates all over the world. The format used to provide this education to students varies widely not only across national boundaries, but also within each country. This chapter deals first with the state of industrial training in engineering education in Spain, both in the old engineering degrees and in the new ones, following the European higher education area requirements, which are now in the process of introduction. An analysis is also carried out on the evaluation and assessment of industrial training when this activity is a part of first cycle engineering curricula, and the role played by the tutor is discussed. Finally, some weak points of industrial training in Spanish curricula are discussed, as well as some proposals to overcome that situation and to move towards a global approach of industrial training in engineering education.

INTRODUCTION

Among the components of innovative curricula in Higher Education courses, practical stages at companies are considered all over the world as one of the most wanted requirements sought by employers. This is especially important for engineering graduates wishing to compete in a global labour market.

These practical stages may take different forms and the way in which they are incorporated to curricula varies widely not only from country to country but also within the same national boundaries. These different forms can be in general referred to as work integrated learning (WIL). In this chapter we consider Industrial Training (IT)

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as a form of WIL very common in Engineering Education. As for the geographical scope of this analysis it will be centred in Spain, with the due reference to the situation in other European countries involved in the development of the European Higher Education Area (EHEA).

IT for engineering students can be approached in three different ways. In one of them, there is a formal allocation of quite large stage periods in companies, lasting up to one or sometimes more semesters, with formal recognition in the curricula of engineering graduates. In the other, practical internship appears as an optional subject, and usually it has short stage periods and it has assigned a low number of credits. Finally, in some study programmes IT is not considered at all, and students engage in it only to improve their curricula vita (CV) and their job prospects.

The contents and nature of the practical stage may be very different, even in the cases in which IT is compulsory. In some cases that period may cover a full semester and there are countries providing public economic support to the student while at the industry. Also, some universities provide students with internships while others, the responsibility rests with the students.

It was with the design of curricula adapted to the EHEA, when different voices were raised asking for including work placements on a compulsory basis in Spanish undergraduate engineering programmes (Domínguez & Magdaleno, 2003; Cámara et al., 2009).

In this chapter a review is carried out of the structure of the new Degrees in Spain and how IT is considered in them. Some proposals are discussed on the methods to improve the evaluation of students and the outcomes of work integrated learning experiences, with a special reference to Mechanical Engineering Degrees in Spain. Finally, there is a discussion on how to improve the present situation of IT in Spanish Engineering curricula.

INDUSTRIAL TRAINING IN ENGINEERING EDUCATION

Practical IT activities can be defined as periods of engineering education outside the University geographical space oriented towards providing the students with knowledge, competences not easily obtained in class-rooms, and carried out while they provide some services to the industries implied in the educational process.

"Practical" and "industrial" terms must be understood here in a broad sense. Practical activities mean those educational tasks that are carried out without requiring more theoretical knowledge over that already gained by the student at the moment when the practical stage is initiated. On the other hand, industrial refers here to any organised human group implied in producing goods or supplying services. In this sense, the term industry includes public or private manufacturing or services firms but also public administrations, co- operatives, trade unions, non-governmental organizations (NGOs), foundations and other collectives.

Work placements play a fundamental role in the education of 21st century engineers who have to act on a global and competitive environment. Many authors involved in engineering education have been working on this issue for many years, and some contributions to this topic can be seen elsewhere (Ahrens, 2000; Domínguez & Magdaleno, 2003; El- Sayed, 2001; Greve et al., 2009; Keleher et al., 2007; Maki, 2002; Patkó et al., 2009; Roelofsen, 2009; Schenck & Boots, 2001; Welters & Van de Wetering, 2009).

Engineering Core Curricula requirements have been discussed in the framework of the Socrates Thematic Network Enhancing Engineering Education in Europe (E4) (Heitmann, 2003). Within the personal requirements for Bachelor Engineering Degrees, those related with the practicum are:

- Function efficiently in project groups and teamwork.