

Work in Progress - The European Higher Education Area (“Bologna process”) in Engineering Education in Spain

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Abstract - This paper analyzes the concerted effort toward the European Higher Education Area, EHEA (“The Bologna process”), and discusses its relevance for the global Engineering Education community through the case in Spain. Confronted with a Europe-wide 2010 deadline for the EHEA convergence, the implementation in Spain of EHEA-conformant undergraduate degrees started in September 2008. Carlos III of Madrid has migrated 80% of its Engineering degrees by mid 2009. As a result, far-reaching modifications in the Spanish educational system were introduced, replacing the government-approved rigid catalog of official engineering degrees by an accreditation process whereby each university can propose its own engineering degrees. Since all degrees must be simultaneously redesigned, synergies can be exploited, aiming at a more integrated, modular design of the engineering curricula and fostering commonality. Concerted adoption of the student effort based on European Credit Transfer System (ECTS) unit of academic measurement may facilitate the seamless combination of face-to-face, distance and blended learning formats. Combined with a common cycle structure and the inclusion of the European Diploma Supplement, the effort will promote mobility and the international dimension in education. This paper provides an update on the project of transformation, its stumbling blocks and challenges as well as its opportunities.

Index Terms - Bologna Process, Engineering curricula, European Higher Education Area, Spanish Universities.

THE EHEA/BOLOGNA PROCESS

European universities, and specifically European engineering schools, are undergoing a deep and rapid transformation through the concerted adoption of the European Higher Education Area, EHEA (“The Bologna process”). Beyond its obvious significance for Europeans, this process is highly relevant for the rest of the Engineering Education community due to: a) Europe’s standing as one of the leading centers of engineering education b) the learning experience deriving from the major challenges faced and the way they are overcome c) the potential applicability of some of the EHEA practices and approaches to other educational

settings. The European Higher Education Area, EHEA (generally dubbed “The Bologna process”), fostering convergence, transferability and best-practice adoption by the 46 participating countries, is aimed at transforming the international engineering education landscape [1]. The Bologna Process Stocktaking Report 2009 [2] analyzes the current status of participating countries, and Europe as a whole, regarding such criteria as: implementation of the three-cycle Degree System, quality assurance, recognition, lifelong learning and mobility and developments on the “Strategy for the European Higher Education Area in a Global Setting”. This paper analyzes the actual experience of the university that is leading the conversion effort in Spain and discusses the opportunities and challenges created by the process itself and by its tight implementation schedule. These might be useful for other European universities, as well as for other faculty members who are either interested in the increasingly integrated global education scenario or involved in other transformation, redesign or conformance projects, e.g. those related to the ABET EC2000 criteria [3].

INITIAL IMPLEMENTATION STAGES IN SPAIN

As the Europe-wide 2010 deadline for convergence to the agreed specifications for the EHEA draws closer, actual implementation in Spain of EHEA-conformant undergraduate degrees started in September 2008. The public university, Carlos III of Madrid (UC3M) was the only one to embrace a big-bang conversion approach, proposing a replacement of all its existing engineering degrees by the new ones [4].

80% of these proposals were approved by the education authorities, thus in September 2008, for entering freshmen, 8 out of its 10 undergraduate engineering degrees were discontinued, and replaced by new offerings conforming to the new cycle structure, credit transfer system and pedagogical and assessment approach.

CHALLENGES

A number of challenges and stumbling blocks have to be surmounted in this process, such as:

- **Meeting deadlines:** Even though the Bologna Joint Declaration was signed in 1999, in the Spanish case it is only in the last few years that specific preparatory activities have been carried out. Furthermore, the

required regulatory framework has undergone several major course shifts. This has led to the new curricula being designed in a perhaps too short time.

- **Regulated professional requirements:** By the time the new curricula had to be approved, the new guidelines governing requirements for activities requiring professional licenses had not been issued. As a result, the new degrees must therefore undergo some retrofitting. This issue is further complicated by the coexistence of professional licenses that require a bachelor degree and other that require a master degree.
- **Cycle transformation issues and special interests:** Engineering degrees in Spain have traditionally encompassed 5 year "higher engineering" degrees and 3 year "technical engineering" degrees. A long history of rivalry between graduates of these two kinds of degrees, and between their respective professional associations, has made it particularly difficult to find a satisfactory equivalence between the new titles and the existing ones.
- **Controversy:** Due to very diverse reasons (according to some official sources, sometimes due to a distorted view of the EHEA implications), the Bologna process has met strong resistance from various stakeholders. Even the police has been forced to intervene to suffocate student protests.
- **Methodological changes and resources:** A cornerstone of the EHEA process is a set of methodological transformations, moving away from instructor-centered "teaching" towards student-centered "active learning" through continuous evaluation, higher emphasis on practical sessions and focusing on assignments, class projects and hands-on experiences [5]. However, implementing these changes requires significantly higher degree of efforts from faculty members, as well as adaptations in the university infrastructure. Since most Spanish universities are public, this has led to requests for substantial additional funding.
- **Focus shift to learning outcomes. Qualifications framework:** The Bologna Process Stocktaking Report 2009 [2] emphasizes the importance of a shift to an outcomes-based approach to learning. It shows, however, that this transformation from using traditional input/content approaches to output/outcomes approaches to conceive, validate, monitor and express qualifications is proving slow and difficult.
- **Evaluation and academic level:** Engineering education in Spain has traditionally been very demanding academically. Many fear that replacing exacting individual exams with home assignments and group work will dilute this exigent tradition and the associated prestige in the workplace.
- **Motivation and incentives:** A large percentage of the Spanish faculty members are tenured civil servants, on which the universities have very limited influence. Furthermore, the existing incentive and recognition systems are heavily tilted towards research rather than

teaching. Thus some faculty members may not be motivated to undergo the transformation required by EHEA.

OPPORTUNITIES

On the other hand, this massive, simultaneous redesign of all degrees also offers unprecedented opportunities.

- **Curricula integration:** Since all degrees must be simultaneously redesigned, synergies among them can be effectively exploited. In the Carlos III university, this has led to more integrated, modular design of the engineering curricula, fostering commonality both to achieve resource efficiency and to postpone the student's choice among different engineering degrees.
- **Unified measurements facilitate blending:** Until now, the unit of academic measurement, credit, was based on tuition hours: 1 credit meant 10 classroom hours. Shifting the unit of academic measurement to total student effort hours (through the European Credit Transfer System, ECTS) facilitates the seamless combination of face-to-face, distance and blended learning in academic degrees. In degrees that have already migrated, tuition hours per ECTS range from 5 to 10 hours.
- **Mobility and internationalization:** Homogenized academic achievement recognition, through adoption of a common measurement unit (ECTS) and cycle structure, and the inclusion of the European Diploma Supplement should contribute to EHEA's stated goal of promoting mobility and the international dimension in education

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