Chapter 11
Upgrading a Numerical Methods Course into New Mobile Technologies for Mathematical Education:
An Approach Based on Flexibility and Skill Development

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ABSTRACT

Quality and diffusion of science and engineering education is a world challenge for the coming decades. It will require better and differentiated schemes of instruction able to reach the desired standards to combine science, technology and applied knowledge to solve future problems. Current vision is still limited in spite of the incipient use of educative technology in the universities, and despite its continuous growth based on mobile technologies in recent years. This chapter presents an updated vision of the educative evolution in a Numerical Methods course based on the integration of Math and Physics curricula, together with a Blended Learning approach. It describes the current movement towards a flexible scheme powered by mobile applications, the experience gained in the last ten years, and a strong collaborative faculty.

INTRODUCTION

Two decades ago, university faculty were commonly reluctant about the use of technology in education. Nevertheless, as time has gone by and technology has been improved, education has inevitably been a focus in the development of information technology. Today, there is a growing market around technology applied to education. In parallel, there is currently an assumption about education for the digital

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natives' generation (people born after 1980 who supposedly have a strong affinity with technology) which is pushing the educational technology arena. Prensky (2001) states in this sense that they are native speakers of the digital language of computers, video games and the Internet. As an almost immediate conclusion, people born before those years (digital immigrants) have adopted these technologies later in their life, exhibiting in many cases a limited affinity and an uncomfortable feeling with it, particularly in education. Prensky clarifies that some immigrants are going to adapt to their digital environment better than others, but he suggests that they will never compare with digital natives (cited by Sadowski, 2014).

To summarize, several authors (Jardines, 2009; Gray, Thomas and Lewis, 2010; Hobbes, 2013) have stated some relations between the general history of distance learning and the chronology of past generations, in particular in terms of the sensorial stimulus and the learning styles developed in each case in their learning experiences (Internet World Stats, 2014). These chronological changes are imperceptible, but today they are configuring education deeply. Very recently in this history, mobile technologies have become accessible and spread across all educative levels. This accessibility, not always present in their predecessor technologies, has generated a realm of flexibility around learning processes (Johnson et al, 2013).

Johnson, Adams, and Haywood (2011) stated a very fast adoption of mobile technologies in education. Actually, with lots of educative Apps and other applications to develop educational products, the prospect is open to teacher innovation by carrying out several educative trends supported by it. Still, from the author point of view, Higher Education is still an undecided terrain in terms of clarity and overwhelming usage of learning technologies. Nevertheless, it is having an incipient tendency to be explored and increased in recent years. In some senses, Higher Education appears sometimes as the last bastion of traditional education. In contrast, as Laurillard (2005, 2008) has noted, mobile technology is solving different needs to enhance the professional learning of disciplines: abilities for employment, high quality courses and flexibility to study. Mathematical higher education is, at least, one of the most open disciplines for mobile learning technologies, due possibly to its timely skill development at the operational level (more than in terms of extensive competencies development).

Several years ago, the author began introducing complementary technologies in a Numerical Methods course, in addition to those oriented exclusively to develop the planned course skills (Excel, Mathematica, Python, etc.). As a result, in 2011, several technologies were used to start the mobile management as a part of a mobile learning institutional effort (Delgado, 2013). Those complementary resources were first oriented to cover detected weaknesses in the learning process. Over time, while educative mobile tools were improved and spread, they have brought the opportunity to use them as a parallel support of learning management. Recent years have been rich in terms of these developments, and an exponential growth of these tools has been seen. The continuous search and experimentation to apply them in the course and in other educative projects have brought changes in the old educative approach.

The aim of this work is to provide an updated version of a previous report (Delgado, 2013), relating the advances in the use of mobile technologies in the course over the last four years. The first attempt to introduce mobile technologies was reported then. Today, these technologies have shaped the course and the viability to offer it as a pure online version is being considered (based on the growing blended learning experience gained). This report is centred not only on improved technologies, but in the course design and in the comparison between blended and face to face evaluation activities. Also, on an insight, to introduce a more flexible approach for this course in terms of a hybrid learning version. In the second section, a review and a discussion about changes in the last four years in the learning technologies are presented. It states the report research objectives. In the third and fourth sections, the new design