Chapter 12
Long-Term Experiences in Mathematics E-Learning in Europe and the USA

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ABSTRACT

This chapter presents a comparative study regarding four long-term experiences teaching mathematics online at four different universities in Europe and the USA. The chapter first begins by discussing general differences in e-learning adoption between the USA and Europe (with specific focus on asynchronous e-learning). Second, some of the major benefits and challenges of mathematics e-learning are discussed. Third, the chapter describes some specific experiences with mathematics e-learning at the four universities (two European and two American) - these descriptions focus on methodological and practical aspects of the e-learning process in mathematics courses. Finally, a comparative analysis highlights common patterns and differences among the different models and some key factors for successful mathematics e-learning practice are identified along with a set of recommendations.

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INTRODUCTION

Information technologies, broadly, have undergone significant evolution over the past two decades. This in turn has led to changes in higher education practice. In particular, in an effort to explore ways to harness technological innovations and thus improve their educational programs, more and more universities are providing online courses and degree programs, as well as so-called hybrid or blended courses, These innovations, such as virtual learning environments (VLE's), have, for example, driven the growth of online and distance learning opportunities by providing students who are time-bound due to job or travel difficulties, or place-bound due to geographic location or physical disabilities, with access to courses and degree programs at their convenience (Simonson et al., 2003). The resultant growth has been rapid, as evidenced by the proliferation of e-learning models worldwide (Allen & Seaman, 2008; Nagy, 2005).

As in most or all of higher education, mathematics also follows a clear trend towards the increasing use of web resources – e.g. VLE's such as Moodle (http://moodle.org/), Sakai (http://sakaiproject.org/portal) or Blackboard/WebCT (www.blackboard.com/) – and mathematics software – e.g. Mathematica, Maple, Minitab, Statistica, SPSS or R. These technologies both promote and enable the research and development of new instructional approaches. This, in turn, is leading to the development of new roles, strategies and methodologies for mathematics instruction in higher education. The current situation is largely one where the requisite research base (and thus understanding of best-practices) is not keeping up with the fluid changes that continue to occur. This chapter seeks to contribute to filling this gap by providing the first comparative analysis (to our knowledge) of long-term experiences with mathematics e-learning between European and American universities. By doing so, the hope is to begin to identify some of the benefits and challenges encountered by online mathematics instructors as well as students.

The structure of the chapter is as follows: First, growth of e-learning in Europe and the US is discussed and some characteristics and trends are suggested (with a particular emphasis on asynchronous e-learning). Second, the chapter analyzes some of the main benefits and challenges related to offering mathematics courses online. Third, mathematics e-learning experiences at the four universities are presented. These universities are: Open University of Catalonia (Spain), Universidade Aberta (Portugal), State University of New York (USA) and Massachusetts Institute of Technology (USA). Fourth, these experiences provide the means for providing a comparative analysis in which key similarities and differences among the models are highlighted. From this analysis, some best practices and fundamental factors for successful mathematics online courses are deduced. Finally, a conclusion section summarizes the main findings and contributions of the chapter.

While the chapter places particular emphasis on the fully online asynchronous modality (i.e. e-learning as a complete replacement for traditional face-to-face instruction) much of the experiences and lessons shared will also have natural applicability to blended (or hybrid) instruction (i.e. e-learning as a partial replacement for traditional face-to-face instruction).

GROWTH IN E-LEARNING: EUROPE VS. USA

Acting as a complete replacement or as a complement to traditional face-to-face (F2F) instruction, asynchronous e-learning is perhaps the fastest growing segment in the US higher education sector. Asynchronous e-learning, commonly facilitated by media such as email and discussion boards, supports interactions among learners and with instructors, even when participants

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