

Chapter 4

Mathematics Education: Teaching and Learning Opportunities in Blended Learning

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ABSTRACT

This chapter is concerned with the integration of research in mathematics education and e-learning. Its main aim is to provide a perspective on the teaching/learning opportunities offered by e-learning platforms in a blended learning setting, as experienced at the Universities of Salerno and of Piemonte Orientale. Two types of teaching actions have been set above all: a) tailored units of learning, which have required the design/implementation of a huge pool of learning objects, according to domain-specific guidelines from mathematics education research and to various educational parameters from e-learning research; b) cooperative or individual teacher-driven learning activities together with various practice for self or peer assessment, which have been designed according both to e-learning and mathematics pedagogies based on the active role of the learner; the interaction with tutors and peers, and the importance of critical thinking and communication skills. Finally some feedback from students is reported, and some opportunities for future research are outlined.

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INTRODUCTION

This chapter is framed in the areas of e-learning and mathematics education. We assume that integrating research outcomes in both areas is of paramount importance. Lately web-based educational environments specific for mathematics have been developed (e.g. MUMIE, WebALT, MEI online resources for mathematics, MathWiki). Even if we acknowledge the need for specific domain tools, we aim at understanding the potentials of standard e-learning applications and methods for undergraduate education in mathematics. The effort of the author has been devoted to exploit the generic outcomes about e-learning (tools, theories, practices) according to the domain-specific results from research in mathematics education. With this concern, we provide a comprehensive description of e-learning practices related to the state of the art in both e-learning and mathematics education as well as an overview of research in both areas as wide as possible.

Through the chapter we focus on some e-learning experiences in mathematics education, carried out over the last few years at the Universities of Salerno and of Piemonte Orientale (Italy). Some mathematics courses have been supported with e-learning platforms, in a blended way, that mixes face-to-face lectures and distance mathematical instruction. The e-learning platforms used are IWT (Intelligent Web Teacher) in Salerno and Moodle (Modular Object Oriented Dynamic Learning Environment) in Piemonte. The first one is equipped with features of LCMS (Learning Content Management System), adaptive learning system and allows the definition of personalized and collaborative teaching/learning experiences by means of the explicit representation of the knowledge and the use of techniques and tools of Web 2.0. The second one is an open source CMS (Content Management System), an adjustable environment for learning communities, designed to support a social constructionist framework of education.

The main features of the e-learning practices described in the chapter are:

1. generation of personalized units of learning;
2. cooperative or individual, teacher-driven learning activities, along with various practices for self or peer assessment.

As regards item a), platform IWT (compared to Moodle and similar ones) adds the opportunity to effectively represent knowledge domains and manage the related contents. This allows the platform to automatically run a learning process, in terms of contents assessment and remedial materials to be delivered. Moreover IWT can also store and manage learning-related information on the student (e.g. preferred learning style or previous knowledge), which allows it to tailor the learning process, delivering just the contents needed according to the student's preferred style. In order to exploit such feature of IWT, various learning objects (LOs) have been created related to the domain of Linear Algebra and Analytic Geometry. Further, we note that personalization can be student-driven, as he/she can access alternative resources available in the platform and then choose the most fitting to his/her needs or preferences.

Regarding item b), the personalised course has been supported by some teacher-driven learning activities on the platform. Some facilities for cooperative and individual work, such as wiki, forum and task, available both in IWT and Moodle have been exploited for designing mathematical activities in order to encourage students to deepen their knowledge on the subjects at stake. All of these activities are open-ended and thus the problem of their assessment has been posed, and some self- or peer-evaluation procedures have consequently been designed and implemented. The first ones are based on the availability in the platform of solution-patterns students can compare to their products (after they have completed the task). The second ones consist in a peer-evaluation process among students.

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