Chapter 6
Implementation of Learning Outcomes in Mathematics for Non-Mathematics Major by Using E-Learning

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ABSTRACT

Learning outcomes are considered to be a key tool for student-centered teaching and learning. They can be successfully implemented in teaching and learning mathematics on higher educational level and together with appropriate level of technology enhanced learning can provide the framework for successful learning process even for students that have not been primarily interested in mathematics. The aim is to present the case study of implementation of learning outcomes and e-learning in several mathematical courses at the Faculty of Organization and Informatics of the University of Zagreb. First of all, there are examples of mathematical courses in the first year since the first study year is crucial for retaining students. Further, there are mathematical courses taught at higher years of undergraduate study and the first year of graduate study. Again, educational process is appropriately supported by ICT and executed through blended e-learning, as well as the use of social software.

INTRODUCTION

In this chapter the aim is to present the case study of implementation of learning outcomes in several mathematical subjects within study programs of informatics that is supported by e-learning. There are several reasons for implementation of e-learning and learning outcomes and they will be explained later in this chapter. Besides, the theoretical background of learning outcomes, blended learning and teaching mathematics to non-mathematics major will be discussed. There are four courses that serve as case studies and they will be described and analysed in this chapter: Mathematics 1 (1st semester undergraduate study), Mathematics 2 (2nd semester undergraduate), Selected chapters in mathematics (4th semester undergraduate) and Discrete mathematics with graph theory (5th semester undergraduate and 1st semester graduate). These courses are a part of the Information and Business Systems (IBS) study program at the Faculty of Organization and Informatics of the University of Zagreb.

University of Zagreb is the oldest and biggest Croatian and Southeast European University. It was founded in 1669 and today it has around 60 000 students and it consists of 29 faculties, three art academies and two centers. One of the faculties is the Faculty of Organization and Informatics (FOI) founded in 1962, which is today a teaching and research institution providing research in information technology, business system, information sciences in general, as well as in mathematics. There are 2700 students enrolled in the academic year 2009/10 and they are mainly taught in accordance with the blended learning approach. FOI itself has study programs at all levels: undergraduate, graduate and postgraduate, following the Bologna Declaration requirements enforced by law in 2003 and incorporated into the organization of studies.

The main objectives for implementation of e-learning and learning outcomes are to increase retention of students, improve unfavourable position of some underrepresented groups in ICT study, meet the demands of employability, as well as of teaching large heterogeneous student groups. Here, we will briefly introduce two important problems we have been facing: a high drop-out rate and the under-representation of female students in ICT. A high drop-out rate and the fairly long study duration are problems plaguing many Central and East European countries including Croatia. The approach in higher education teaching, which can be summed up as an ex cathedra, teacher-centered approach, used to be a typical pattern of teaching in Croatia before the Bologna reform. This approach was especially common in teaching mathematics. It was one of the factors which caused the high drop-out rate in Croatian universities, especially in those study programs that had mathematics in its first study year. According to two different sources, only 1/3 or 1/2 of enrolled students completed their course of study. The percentage of those who got their diploma in the time set for the course is even lower. The average duration of the study of Informatics (ICT) was between 6 and 7 years instead of 4.5 or 5 years specified by official regulations. The system was inefficient and highly traditional. In such circumstances, even though it has not been widely accepted by all academics, the significance of the Bologna reform is in its contribution to creating solutions and introducing necessary changes. In this context it is particularly necessary to reflect on teaching and learning mathematics.

Furthermore, women seem to be strongly underrepresented in ICT. This is partly the result of many myths about underperformance of women in typically male areas such as ICT and mathematics. Between 250 and 300 students enrol in the undergraduate study programs of Informatics at FOI each year and among them only about 20% are female students. Therefore the specific objective of the research reported here is to improve student retention in mathematics by means of enhancing teaching methods, with the awareness of gender issues. Further, because the University of Zagreb

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