

## Chapter 8

# Student Performance in E-Learning Environments: An Empirical Analysis Through Data Mining

**Constanta-Nicoleta Bodea**

*Academy of Economic Studies, Romania*

**Vasile Bodea**

*Academy of Economic Studies, Romania*

**Ion Gh. Roşca**

*Academy of Economic Studies, Romania*

**Radu Mogos**

*Academy of Economic Studies, Romania*

**Maria-Iuliana Dascalu**

*Academy of Economic Studies, Romania*

### ABSTRACT

*The aim of this chapter is to explore the application of data mining for analyzing performance and satisfaction of the students enrolled in an online two-year master degree programme in project management. This programme is delivered by the Academy of Economic Studies, the biggest Romanian university in economics and business administration in parallel, as an online programme and as a traditional one. The main data sources for the mining process are the survey made for gathering students' opinions, the operational database with the students' records and data regarding students activities recorded by the e-learning platform are. More than 180 students have responded, and more than 150 distinct characteristics/variable per student were identified. Due the large number of variables data mining is a recommended approach to analysis this data. Clustering, classification, and association rules were employed in order to identify the factor explaining students' performance and satisfaction, and the relationship between them. The results are very encouraging and suggest several future developments.*

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## INTRODUCTION

The need for continuing adaptation of workforce and the demand for more flexible ways of acquiring competencies are the factors which motivate the use of e-learning. E-learning is recognized as a fundamental tool for a lifelong learning society. Therefore, e-learning become a strategic vector in development of knowledge-based economy (Charpentier, Lafrance & Paquette, 2006). In the same time, the student interest in online courses has increased over time. As a result, more and more courses, even entire programs, are now delivered by means of information technology or offered online.

This change in education & training industry has as a consequence the intensification of research on e-learning. Researchers want to discover students' preferences for various tools and e-learning platforms, the relationships between online learning and different learning styles, or the factors affecting student performance and satisfaction in the online environments (McFarland & Hamilton 2006).

The research in e-learning domain is facilitated by the extensive amount of data stored by the e-learning systems. Most of these systems have the ability to collect data about the student activities, tracking navigational pathways through educational resources, time spent on various topics, or number of visits. Also, the e-learning systems capture data about the amount and type of resources usage. This data often are the basis of the research.

One way to better understand of data is data mining. By data mining, it is possible to discover patterns to be used in predicting student behavior and efficient allocation of resources.

(Romero & Ventura, 2007) present the main findings of an educational data mining survey covering the period 1995-2005. (Baker & Yacef, 2009) made another survey covering the latest data mining approach in education domain. Both surveys show that the number of data mining appli-

cations in education is constantly increasing, and they cover a lot of educational processes such as: enrollment management, academic performance, web-based education, retention.

Many case studies on data mining techniques in education are cited in the literature (Luan, 2002), (Ma & al, 2000), (Barros & Verdejo, 2000), (Ranjan & Malik, 2007). These case studies aim at predictions of student performance, mainly through cluster analysis to identify relevant types of students. (Delavari & al, 2005) proposed a model for the application of data mining in higher education. (Shyamala & Rajagopalan, 2006) developed a model to find similar patterns from the data gathered and to make predication about students' performance.

(Luan, Zhai, Chen, Chow, Chang & Zhao, 2004) presented different case studies on educational data mining. One of these studies intended to highlight factors that determine the academic success of first-year students. The methods used are classification and regression trees and neural networks. There were generated decision trees, and association rules. A sensitivity analysis was performed to analyze factors. Variables considered were demographic variables and performance indicators before college. By this analysis can be achieved overall average prediction in the year. The analysis carried out by two classes of methods showed that the most important factors for academic success in first year of college are SAT scores (average of high school equivalent) and position in the rankings achieved on average in high school.

Another case study was developed at Cleveland State University. The purpose of this study was granted financial aid to assist students to explore the effects that might be changing the rules on admission and to promote data mining techniques to build models to improve student services. Research objective is to identify key indicators that predict the best students stay in college and ultimately graduating. The data used are available at registration. Data used in the study covers the

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