

# Chapter 16

## Mining Student Participatory Behavior in Virtual Learning Communities

**Constanta-Nicoleta Bodea**

*Academy of Economic Studies, Romania*

**Vasile Bodea**

*Academy of Economic Studies, Romania*

**Ion Gh. Roșca**

*Academy of Economic Studies, Romania*

**Radu Ioan Mogos**

*Academy of Economic Studies, Romania*

**Maria-Iuliana Dascalu**

*Politehnica University of Bucharest, Romania*

### ABSTRACT

*The aim of this chapter is to explore the application of data mining for analyzing participatory behavior of the students enrolled in an online two-year Master degree programme in Project Management. The main data sources were the operational database with the students' records and the log files and statistics provided by the e-learning platform. 129 enrolled students and more than 195 distinct characteristics/variables per student were used. Due to the large number of variables, an exploratory data analysis through data mining is decided, and a model-based discovery approach was designed and executed in Weka environment. The association rules, clustering, and classification were applied in order to describe the participatory behavior of the students, as well as to identify the factors explaining the students' behavior; and the relationship between academic performance and behavior in the virtual learning environment. The results are very encouraging and suggest several future developments.*

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## INTRODUCTION

Educational Data Mining (EDM) is a discipline, concerned with “developing methods for exploring the unique types of data that come from educational settings, and using those methods to better understand students and the settings which they learn in” (International Working Group on Educational Data Mining, 2010). (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 applications 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. Using data mining, it is possible to discover students’ behavior pattern and the relationship between behavior pattern and student performance.

(Baker & Yacef, 2009) comment an important EDM methods category, named “discovery with models”. Such methods are relying on models previously developed through any process which are used as components of data mining analysis. “Discovery with models has become an increasingly popular method in EDM research, supporting sophisticated analyses such as how different type of student behavior impact students’ learning in different ways (Cocea et al, 2009) and how variations in intelligent tutor design impact students’ behavior over time (Jeong & Biswas, 2008)”.

Students’ behavior in the virtual environment is a complex topic, too difficult to be address only

based on an unstructured exploratory analysis, as it is done in data mining. A model-driven discovery process has the potential to reveal unusual behavioral profiles or unexpected relationships between different characteristics and the behavior pattern in a more structured way, reducing the complexity and making the process more manageable. In this chapter, the authors considered Unified Theory of Acceptance and Use of Technology (UTAUT) as the model to be used for structuring the EDM process.

The UTAUT model (Venkatesh et al, 2003) integrates different theoretical frameworks and variables that influence the behavioral intention of technology adoption and use. The four constructs that were considered as direct determinants of user acceptance and usage behavior are the following: performance expectancy, effort expectancy, social influence and facilitating conditions. The *performance expectancy* represents the degree to which an individual believes that using the technology will help him/her in performance gains. The *effort expectancy* is the level of simplicity associated with the use of the system. The *social influence* is defined as the extent in which an individual perceives that important others believe that he/she should use the system. And finally, the *facilitating conditions* reflect the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system. The UTAUT model incorporates also moderator variables such as age, gender, prior experience and voluntariness of the technology use.

UTAUT was already used to discover the factors that influence medical teachers’ acceptance of information and communication technology (ICT) integration in the classroom (Birch & Ervine, 2009), to investigate the determinants of mobile Internet acceptance and to find out the extent to which students used and accepted M-Learning as an education delivery method (Williams, 2009).

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