A Systematic Mapping on the Learning Analytics Field and Its Analysis in the Massive Open Online Courses Context

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ABSTRACT

Learning Analytics (LA) is a field that aims to optimize learning through the study of dynamical processes occurring in the students' context. It covers the measurement, collection, analysis and reporting of data about students and their contexts. This study aims at surveying existing research on LA to identify approaches, topics, and needs for future research. A systematic mapping study is launched to find as much literature as possible. The 127 papers found (resulting in 116 works) are classified with respect to goals, data types, techniques, stakeholders and interventions. Despite the increasing interest in field, there are no studies relating it to the Massive Open Online Courses (MOOCs) context. The goal of this paper is twofold, first we present the systematic mapping on LA and after we analyze its findings in the MOOCs context. As results we provide an overview of LA and identify perspectives and challenges in the MOOCs context.

Keywords: Learning Analytics, Massive Open Online Courses, MOOCs, Students' Data Analysis, Survey, Systematic Mapping, Technology-Enhanced Learning, TEL

1. INTRODUCTION

Learning Analytics (LA) is a significant area of Technology-Enhanced Learning (TEL) that has emerged during the last decade. It aims to optimize learning through the study of the dynamical processes occurring in the context of the student.

LA is a fast-growing area that has strong roots in a variety of fields, involving Business Intelligence, Web Analytics, Educational Data Mining, Recommender Systems, Machine Learning, Artificial Intelligence, Information Retrieval, Statistics and Information Visualization, etc. (Chatti, Dyckhoff, Schroeder, & Thüs, 2012;

Ferguson, 2012). LA techniques are applied to help the comprehension of the learning process and also to improve it. These techniques can be applied to analyze data gathered from Massive Open Online Courses (MOOCs).

MOOCs are said to be a new form of online learning (Margaryan, Bianco, & Littlejohn, 2014). Millions of people are learning in hundreds of MOOCs offered by universities and other public and private organizations worldwide. Yet there is very little empirical research into MOOCs and their effectiveness for learning (Margaryan et al., 2014).

Despite the increasing interest in LA and MOOCs, we haven't found studies relating them. The goal of this paper is twofold. First we present the systematic mapping on LA to analyze several aspects of LA such as data, techniques, stakeholders, goals and interventions (the actions made to impact on the learning process). Then we analyze the same aspects in the context of MOOCs. As results, we provide an overview of LA and identify perspectives and challenges in the MOOCs context.

This paper is organized as follows: first we briefly describe the LA field in order to provide background to our systematic mapping; followed by the methodology adopted to conduct the study. Next we show the results of this study. We then analyze LA works in the MOOCs context discussing the results of the systematic mapping and crossing it with the study about MOOCs. Finally we present our conclusions and the references.

2. LEARNING ANALYTICS

Learning Analytics is "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" ("1st International Conference on Learning Analytics and Knowledge 2011", 2014). LA is applied at the discipline, course and department levels providing valuable information about what is happening and suggesting ways in which educa-

tors can improve the learning process (Siemens & Long, 2011). LA can also tell which students may quit the course or those who need special attention to improve their performance.

A reference model for LA was proposed by Chatti et al. (2012) and has the same dimensions adopted by Atif, Richards, Bilgin and Marrone (2013). We deeper describe these dimensions based on Atif et al. (2013) and Chatti et al. (2012) providing some examples for better understanding:

- **What?** This dimension refers to the data collected (i.e., the kind of data that the system gather, manage, and use for the analysis). These data can be from the virtual learning environment (VLE), from institutional sources, from social media like Facebook and Twitter, etc.
- **Who?** This dimension refers to the stakeholders (i.e., who is targeted by the analysis). They can be teachers, administrators of the educational institution, researchers, system designers, students, etc. Each one of them has its own perspectives, goals and expectations about the learning practice.
- **Why?** This dimension is related to the objectives of the analysis (i.e., why does the system analyze the collected data). Atif et al. (2013) and Chatti et al. (2012) consider the following objectives:
  1. **Monitoring and Analysis:** it has as objective to monitor the students' actions and generate reports with the analysis results.
  2. **Prediction and Intervention:** it develops a model that attempts to predict the future student performance based on his/her actions and actual accomplishments, providing indicator about students who may need special attention and the intervene on his/her behalf.
  3. **Tutoring and Mentoring:** it helps the student through a specific learning module (tutoring) or during the whole course (mentoring).

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