

# Using Learning Analytics to Support Applied Research and Innovation in Higher Education

Julià Minguillón, Francesc Santanach, Christine Appel

eLearn Center  
Universitat Oberta de Catalunya  
Barcelona, Spain  
{jminguillona, fsantanach, mappel}@uoc.edu

## Abstract

We live in a digital world. Most of our daily activities involve the use of digital devices or services that leave a trace behind them. These traces can be analyzed in order to better understand user's behaviour and improve the quality of services accessed by them.

Education is not (or should be not) an exception. A vast majority of traditional brick-and-mortar educational institutions provide their learners, to some extent, with digital spaces where the teaching and learning processes are extended and supported. This means that learners' interaction within the virtual learning environment (VLE) can also be analyzed. As summarized by Siemens and Gasevic (2012), learning analytics is defined as "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. ... High expectations exist for learning analytics to provide new insights into educational practices and ways to improve teaching, learning, and decision-making."

Nevertheless, setting up a learning analytics framework is not an easy task. Usually, VLEs integrate a wide range of systems with different underlying technologies, such as communication tools, virtual libraries, digital repositories, social networks, web 2.0 tools and so on. Although VLE users may seamlessly navigate through these different information systems and tools, this is not the case from the perspective of the data captured and gathered in each one of them. On the contrary, several problems such as data fragmentation, duplication, the use of different identifiers and non-standardized vocabularies are typical, thus making the analysis of such data altogether very difficult.

Since its inception in 1994 as a purely online university, the Universitat Oberta de Catalunya (UOC) has been able to position itself among the main universities of the Catalan and Spanish university systems. Most of the learners at the UOC (currently more than 60,000) are adults who have a profile that could hardly fit into the traditional university system, as through the UOC they are given an opportunity to start or complete their higher education degrees, in a very innovative environment. The intensive use of ICTs for both the teaching/learning processes and management allows researchers and practitioners to obtain data about what takes place on the UOC Virtual Campus which, in turn, undergoes continuous improvement thanks to such findings. The eLearn Center (eLC) at UOC aims to provide both the framework and the ground for implementing such continuous changes in

the university's educational model and the VLE, providing researchers and practitioners with instruments and a controlled setting for experimentation, measuring their impact, collecting the necessary data and evaluating their scalability in order to convert every experience into a good practice, facilitating rapid adoption and dissemination. Thus, the role of the eLearn Center is to consolidate the UOC as a potential e-learning laboratory by means of managing effectively innovation synergies, supporting big data analyses, and having an active role in the design of our educational model, internal faculty/staff training programs and informing a strong and innovative technological strategic plan.

Currently now, a huge OLAP based on relational databases is used to store all the relevant information needed for administrative purposes, while all users' interaction with the VLE is partially stored in different servers with their corresponding databases and/or log files, thus reproducing the aforementioned problems. In fact, learning analytics has been always a reality at UOC since its inception, but important barriers regarding accessing UOC's data have restrained researchers and practitioners to exploit its full potential.

As part of the recent institutional strategic plan, a new approach for capturing, storing and providing e-learning practitioners with data has been implemented. Fostered by the eLC, a new Learning Record Store (LRS) named eLC-LA has been deployed, according to the following criteria:

- It serves all the UOC community of e-learning researchers (including PhD candidates) and practitioners, but also university managers.
- It provides a single entry point for all data requests, under an unified framework and with a common vocabulary shared by all UOC community, so it is easy to combine data from different sources.
- It addresses related aspects such as privacy and ethical issues, ensuring data anonymization, completeness and quality, among other desirable properties.
- It does not replace the current OLAP system, but it is seamlessly integrated into the daily workflow of all UOC departments without changing it.
- Last but not least, it is based in a simple (and cheap, and fast if possible) but scalable technological solution.

From a technical perspective, eLC-LA consists of a single "flat" table containing tuples [U(D), T, S, R, X] that describe all the interaction between VLE users, resources and services, as well as a few additional tables for describing users (U) and resources (R and X). Using this activity-based data model, every interaction with the VLE is described as "user U (optionally using device D), at moment T, applies service S on resource R with result X". Therefore, we capture all the users' activities (i.e. S, services) that can be of interest for learning analytics purposes, under a common unified framework that simplifies further procedures such as data preprocessing, analysis and visualization.

Approximately,  $10^9$  activity traces are captured and stored each academic semester. Currently now, the eLC-LA LRS is already providing data to strategic institutional issues such as analyzing dropout causes, providing better support to learners accessing by mobile devices, or improving continuous evaluation through the institutional VLE, among others.

Several innovation projects and large research projects such as TeSLA (An Adaptive Trust-based e-assessment System for Learning, H2020 funded project) will also benefit from eLC-LA LRS capabilities. Our next step is providing teachers and learners with visualizations that help them to situate themselves in their teaching / learning process, respectively.

Finally, once the eLC-LA LRS is widely used within UOC, it will be interesting to consider providing external and third parties with open data, promoting the exchange of measurable educational experiences, thus contributing to the advance of both applied research and innovation based in best e-learning practices. With the eLC-LA LRS, we expect UOC to position itself as a reference for sharing educational data among higher education institutions.

## **References**

Siemens, G.; Gasevic, D. (2012). Guest Editorial - Learning and Knowledge Analytics. *Educational Technology & Society*, 15(3), 1–2.