From Analysis to Improvement: Challenges and Opportunities for Learning Analytics

Mariluz Guenaga, and Pablo Garaizar

Abstract—Learning analytics (LA) is a multidisciplinary area of research where education, statistics, and technology experts collaborate with other disciplines to get insights from learning data sets. This involves a continuous cycle of gathering data from teachers' and students' interactions, filtering and translating it to proper formats, using a wide range of analysis techniques and starting again after taking advantage from results found. Considering the variety of expertise involved, the need for sharing knowledge and experiences is highlighted in relevant forums such as the Learning Analytics and Knowledge (LAK) Conference. The same happens at Spanish level with the Learning Analytics Summer Institute (LASI-Spain) and the Spanish Network of Learning Analytics-(SNOLA). Research works presented in this special issue show the ability of analysing and improving learning and teaching processes through LA. These three papers address different educational challenges such as assessing massive collaborative projects, evaluating the accessibility and usability of open educational resources and mapping them with the IMS Caliper standard, and using social network analysis to evaluate the socio-regulation skills among students.

Index Terms—Learning analytics, education, social network analysis

I. INTRODUCTION

Learning Analytics is a research area that joins experts in learning technology, artificial intelligence, pedagogy, data mining or psychology, with managers, administrative staff, policy makers and industry related to education. Although the area has made a big progress since its inclusion in the Horizon-2011 report, there were previous research works that used similar techniques in closely related areas such as Educational Data Mining. This combination of experience and novelty involves a remarkable improvement in the quantity and quality of research works, and the implementation in real contexts has enabled their validation.

The increasing amount of data available about students and teachers offers great opportunities. However, many expectations have arisen around the possibility of adapting student learning, recommendation systems, personalized learning or the formative assessment based on the analysis of data from students' interaction with learning technologies. There is a need to evaluate which of these expectations are realistic and under which conditions they are feasible. The ultimate goal of Learning Analytics is to gather evidences about its impact on the improvement of the teaching and learning process.

Due to its nature, LA is a multidisciplinary field where technologists, pedagogues and other stakeholders must collaborate to capture, process, and interpret generated information from an educational perspective. This is, in the end, what differentiates LA from other disciplines related to massive data analysis. The next edition of the Learning Analytics and Knowledge Conference-LAK 2016, a reference event in the area, highlights the need to create multidisciplinary forums and synergic connections with other research communities to address current challenges in the education sector.

LA community faces many and diverse challenges. Among others, technical problems derived from data management due to their origin and heterogeneous nature (multiple sources and formats, lack of standardization), their quality (the need to discriminate useful data from the large amount of data available and work towards standardization), the diversity of tools and techniques for their processing, and an effective visualization so users can understand and benefit from generated information. In addition to these technological challenges we have to address the pedagogical ones, such as the importance of involving teachers and students in the LA process, the need to validate with evidences the impact on education (either positive or negative), the use of LA in formal and informal contexts, the identification of behavioural patterns among students, or the

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pedagogical interpretation of information generated after data analysis.

This special edition aims at addressing some of these challenges and considers different approaches for its implementation and adoption. Its development coincides in time with the Learning Analytics Summer Institute-LASI 2015 in Bilbao (Spain), and the recognition of SNOLA– the Spanish Network of Learning Analytics– as a Thematic Network of Excellence by the Spanish Ministry of Economy and Competitiveness. Both milestones, together with the edition of this special issue, represent a major boost for the Spanish community of Learning Analytics and a proof of collaboration among their members.

II. Special Issue

The papers received for this special issue were evaluated by a panel of 18 experts. After a rigorous reviewing process, in which each paper was evaluated by three reviewers, the following papers were selected to be published in this special issue of the IEEE RITA journal: "*Learning Opportunities for Mass Collaborative Projects through Learning Analytics: a Case Study*", "*Academic Social Networks and Learning Analytics to Explore Self-Regulated Learning: a Case Study"* and *"Co-Creation and Evaluation of Inclusive and Accessible Open Educational Resources: a Mapping towards the IMS Caliper*".

Jordi Sancho, in his work "*New learning opportunities for massive collaborative projects through learning analytics: a case study*" departs from a personal experience evaluating massive collaborative projects to show the potential of Learning Analytics. Students' progress monitoring, formative assessment and the evaluation of students' work in real time are possible thanks to techniques such as social network analysis, factorial analysis, K-means clustering and predictive algorithms. This paper highlights another interesting LA challenge: the need to give more relevance to pedagogical over technological aspects. LA disciplines emerge from the computer science field (i.e. data mining, social network analysis, machine learning, etc.) and it is necessary to focus on improving teaching and learning processes.

In the second paper, "*Academic Social Networks and Learning Analytics to Explore Self-Regulated Learning: a Case Study"*, Adriana Gewerc and Ana Rodríguez-Groba use social network analysis techniques to study the regulation and socio-regulation skills among students, as well as the evolution of these interaction and collaboration networks.

In the last work, "*Co-Creation and Evaluation of Inclusive and Accessible Open Educational Resources: a Mapping towards the IMS Caliper",* Cecilia Ávila, Silvia Baldiris, Ramón Fabregat and Sabine Graf show a model for the co-creation of Open Educational Resources (OERs) whose accessibility and quality is evaluated using different Learning Analytics techniques. The model is mapped with IMS Caliper, a standard that provides high-level recommendations about how learning systems have to collect and share data about users' interaction. This work remarks one of the biggest challenges we face: the relevance of adopting standards for the data definition and processing, as it will increase the interoperability of developed LA systems.

III. Acknowledgments

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