A Complete Validated Learning Analytics Framework:
Designing Issues from Data Use Perspective

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ABSTRACT

Advances in technology have given the learning analytics (LA) area further potential to enhance the learning process by using methods and techniques that harness educational data. However, the lack of guidelines on what should be taken into considerations during application of LA hinders its full adoption. Therefore, this article investigates the issues that should be considered during the design of LA experience from the data use perspective. The results obtained present a validated LA framework which is composed of eighteen validated key issues that should be considered by various stakeholders in their contexts to enhance designing LA experiences. This framework can also be used by researchers and practitioners to learn more about LA and its designing issues.

KEYWORDS
Learning Analytics, Analysis, E-Learning Assessment, Adaptive Learning, Personalization

1. INTRODUCTION

Learning mediums and environments have evolved over time from the classic learning with blackboard in classrooms to the online and open courses in smart learning environments. Koper (2015) defined smart learning environments as environments that are considerably improved using technology to enhance learning. Traditional assessments of the learning process can be incongruent with the use of these new smart environments and mediums. Xing et al. (2015) stated that assessing students in traditional classrooms is difficult and it becomes more difficult in online and open learning environments. In higher education, institutions are being challenged to increase their understanding of learners’ needs (Lawson et al., 2016). Researchers and practitioners have been struggling to keep up with the rapid proliferation of digital tools (Bienkowski, Feng, & Means, 2012; Means, Anderson, & Thomas, 2012). Thus, new methods to assess learners and enhance the learning process are needed.

Learning analytics (LA) has emerged as a very promising area with techniques to effectively use the data generated by learners while learning (Aljohani & Davis, 2012), which can then be used to

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assess learners and enhance learning process. LA applications in education are expected to provide institutions with opportunities to support student progression, detect at risk students and provide a personalized learning experience (Rientes, Cross, & Zdrahal, 2016; Tempelaar, Rientes & Giesbers, 2015).

Data collected from various educational sources can have multiple meanings. Thus, serious concerns are associated with LA application (Ifenthaler & Tracey, 2016; Pardo & Siemens 2014). Ferguson and Clow (2016) stated that gathering evidence about the success and failure of LA is difficult, since researchers and workplace educators often find themselves stopped by a payment procedure when they try to access important scientific papers. Besides, not many educational institutions have succeeded to fully address the use and ethical implications of LA due to their policy frameworks (Prinsloo & Slade, 2013). Therefore, the main research question that this study aims to answer is what are the issues that different stakeholders should consider when approaching the design of learning analytics experiences from the data use perspective?

To answer this research question, an LA framework of designing issues was developed based on two stages. The first step was to identify as many issues as possible for different stakeholders based on two stages from the data use perspective. The second step was to validate the proposed framework by a group of international experts. This framework aims to guide researchers and practitioners about the issues to consider for an efficient design of LA experiences from the data use perspective.

The rest of this paper is organized as follows. Section 2 does a literature review about learning analytics. Section 3 presents the developed LA framework while section 4 validates it. Finally, section 5 concludes the paper with potential future directions based on this study.

2. LITERATURE REVIEW

Learning analytics is rooted in data science, artificial intelligence, practices of recommender systems and business intelligence. Cooper (2012) suggested that a single definition of LA is impossible because of the broad range of perspectives and motivations involved. For instance, Siemens (2010) defined LA as “the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning.” Fournier, Kop and Sittia (2011) considered LA 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.” Van Barneveld, Arnold and Campbell (2012) defined LA as “the use of analytic techniques to help target instructional, curricular, and support resources to support the achievement of specific learning goals.”

LA approaches typically rely on data obtained from learners’ interactions with information and communication technologies, such as learning management systems and social media (Gašević, Dawson, Rogers & Gasevic, 2016). From an institutional perspective, LA can improve decision making and resource allocation, highlight an institution’s successes and challenges and increase organizational productivity (Long & Siemens, 2011). Research work in LA has also demonstrated much potential for understanding and enhancing the learning process. Powell & MacNeill (2012) identified five potential purposes of LA which are: (1) Provide learners feedback about their learning progress compared to their colleagues; (2) Identify at risk students; (3) Help instructors to plan interventions when needed; (4) Enhance the designed courses; and, (5) Support decision making when it comes to administrative tasks. Furthermore, while the most used method to model learners is questionnaire, Tili, Essalmi, Jenni, Kinshuk and Chen (2016) proposed a new approach which uses LA for modeling learners implicitly in a computer-based learning environment.

Despite the importance of LA and its application in different institutions, it still faces some serious challenges and considerations (Pardo & Siemens 2014). For instance, ethical issues have been addressed in varying degrees within LA area from the outset of a range of contemporary practices which use learner-level data to predict results and apply interventions (Willis, Slade & Prinsloo,
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