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Assessing the suitability of student interactions from Moodle data logs as predictors of cross-curricular competencies

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ABSTRACT

In the past decades, online learning has transformed the educational landscape with the emergence of new ways to learn. This fact, together with recent changes in educational policy in Europe aiming to facilitate the incorporation of graduate students to the labor market, has provoked a shift on the delivery of instruction and on the role played by teachers and students, stressing the need for development of both basic and cross-curricular competencies. In parallel, the last years have witnessed the emergence of new educational disciplines that can take advantage of the information retrieved by technology-based online education in order to improve instruction, such as learning analytics.

This study explores the applicability of learning analytics for prediction of development of two cross-curricular competencies – teamwork and commitment – based on the analysis of Moodle interaction data logs in a Master's Degree program at Universidad a Distancia de Madrid (UDIMA) where the students were education professionals. The results from the study question the suitability of a general interaction-based approach and show no relation between online activity indicators and teamwork and commitment acquisition. The discussion of results includes multiple recommendations for further research on this topic.

1. Introduction

Online educational technologies have changed the classroom in blended-learning and online learning environments, with higher education teaching consisting primarily of online lectures, interactions and activities (Phillips, Maor, Preston, & Cumming-Potvin, 2012). The implementation of Learning Management Systems (LMS) or Virtual Learning Environments (VLEs), and the interactions occurring in them, generate a wide array of data that some researchers relate positively to student effort (Campbell, DeBlois, & Oblinger, 2007), performance (Macfadyen & Dawson, 2012) and outcomes (Archer, Chetty, & Prinsloo, 2014; Hrastinski, 2009). This informational phenomenon has given impulse to new areas of research on the relationship between academic performance and interaction data, as a way to achieve a better understanding of online learning (Romero & Ventura, 2007).

In parallel, the European Credit Transfer and Accumulation System (ECTS) and the European Higher Education Area (EHEA) have made strong emphasis on the capital role of mobility and training in instructional competencies. However, the objectives of the EHEA go beyond knowledge acquisition and the application of such knowledge to professional life, and aims to incorporate student training to a holistic model which also includes the acquisition and development of generic, cross-curricular competencies. Nonetheless, the effective integration of these skills into the formal education framework is still a pending subject. As Cobo (2013) notes, "Today it is still a challenge for educational institutions (particularly the more conventional ones) to know how to measure, quantify and qualify these skills" (p. 81).

Therefore, institutions, teachers and learners are deeply concerned about the development of new tools and methods aiming to improve academic performance (Voogt & Roblin, 2012) and help measuring and developing the competences demanded by the labor market (Zapata, 2010), while at the same time they are currently facing the financial crisis and grappling with the lack of educational and financial resources (Ibarra Sáiz & Rodríguez Gómez, 2011).

In this state of affairs, and motivated by technological, pedagogical, political and economic drivers (Ferguson, 2012), Learning Analytics (LA) emerges as a field which allows teachers to accurately identify the needs of students and tailor instruction accordingly (Dyckhoff, Zielke, Bültmann, Chatti, & Schroeder, 2012). By offering

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information in real time, LA can support immediate alterations, suggesting a model of curriculum that is more fluid and open to change (Johnson, Smith, Willis, Levine, & Haywood, 2011).

One of the main objectives of LA is the interpretation and contextualization of the data for improved learning (Agudo-Peregrina, Iglesias-Pradas, Conde-González, & Hernández-García, 2014; Siemens, 2013). In LA, this interpretation of data is generally based on collections of the traces that learners leave behind and on the use of those traces to improve learning (Duval, 2014).

Nevertheless, tracking students in a LMS poses a big challenge, since their databases store an overwhelming amount of data, but not all of them are meaningful for educational and pedagogical purposes (Anderson, 2003; Archer et al., 2014). Agudo-Peregrina et al. (2014) establish a theoretical and empirical basis for the application of LA techniques upon three different classifications of the interactions registered in a LMS: (1) agent-based interactions; (2) frequency of use-based interactions; and (3) participation mode-based interactions. In their study, the authors confirm the existence of significant relations between some types of interactions and student outcomes for the all of the three classifications.

This research considers the suitability of a similar approach to study the relation between the interactions occurring in a LMS and the development of cross-curricular competencies – more specifically, commitment and teamwork – and therefore proposes the following research questions:

R1. Can interactions extracted from LMS log data predict teamwork and commitment levels in online learning contexts?

R2. If so, what is the relative influence of the different types of interactions in the acquisition of commitment and teamwork in online learning?

This paper is structured as follows: Section 2 covers a literature review on learning analytics and cross-curricular competencies, namely teamwork and commitment; Section 3 presents the research methodology and sample characteristics; Section 4 shows the results from the empirical data analysis; in Section 5, the authors discuss the findings from the study, address its limitations and offer avenues of further research; finally, Section 6 summarizes the conclusions.

2. Theoretical background

2.1. Increased knowledge by categorization of interactions in a LMS

Students leave a data trail while they are interacting with others, with information and with institutions through different technologies (Siemens et al., 2011). LMS Redundant have the capability of retrieving data about students' activity, be it posts on forum discussions, access to contents, answers to quizzes or whichever other assessment methods available. These interactions, in formal education contexts, have become an essential part of electronic learning processes (Donnelly, 2010) since they are specifically designed to induce direct learning toward defined and shared learning objectives or outcomes (Anderson, 2003).

Prior studies, such as Long & Siemens's (2011), point out that LMS are a data source that can help to predict students' academic achievement; Dawson, McWilliam, and Tan (2008) state that data about the number of times a student interacts with the learning system provide useful information about their participation, making it easier to guide students and improve their academic performance; Pascual-Miguel, Chaparro-Peláez, Hernández-García, and Iglesias-Pradas (2011) point at active interactions in message boards as potential indicators of learning; and Beer, Clark, and Jones (2010) and Macfadyen and Dawson (2012) prove the existence of behavioral patterns from the information about student interactions, and find a correlation of said interactions with final academic performance.

As Beer, Jones, and Clark (2009) note, interactions may be indicators for learning outcomes. Beer et al. (2009) explored the use of LMS usage data to identify potential indicators of effective learning, and came to the conclusion that there is a significant relation between staff interaction and student's final grade. In this sense, Agudo-Peregrina et al. (2014) confirm the positive correlation between different types of interactions and academic performance in distance learning, and suggest that they may be reliable variables to create predictive models of learning outcomes.

Agudo-Peregrina et al. (2014) maintain that interactions are the most basic unit of learning data in virtual learning environments for learning analytics, and that each of these interactions is represented by a data log record stored in the system's database. According to Agudo-Peregrina et al., there are three system-independent classifications of learning interactions in a LMS (Table 1).

As mentioned in Section 1, our study draws upon these three categorizations of educational interaction data and applies statistical analysis to explore the potential relation of these indicators and the development of cross-curricular competencies.

2.2. The relevance of cross-curricular competency development in online learning

Educational institutions and researchers are striving to promote cross-curricular competencies, especially inter-personal competencies (OECD, 2012). Inter-personal, cross-curricular competencies help students to interact with each other (Rodríguez Esteban, 2012), and this interaction is considered a fundamental pillar of learning and training (Zazo-Bello, Agudo-Peregrina, & Calero-Ruiz, 2012).

Cross-curricular competencies can eventually be seen more as hard-skills than soft-skills (Cobo, 2013) and are essential for the integration of students in the labor market (Alonso, Fernández Rodríguez, & Nyssen, 2009; Bayona Bohórquez & Heredia Cruz, 2012; Corominas et al., 2006; González & Wagenaar, 2003), a market that demands professionals able to work in teams in networked structures (Dragomirescu-Gaina & Weber, 2013). Two of these competencies, commitment and teamwork, are critical for students to achieve professional success, as they relate to their ability to effectively collaborate from an individual and social standpoint, respectively (Palmer Pol, Montaño Moreno, & Palou Oliver, 2009).

2.2.1. Commitment

From the student's perspective, commitment refers to "the active and responsible participation of the student in his or her learning process" (Ruiz, 2013, p. 32). From this definition, commitment has two different dimensions: the first is related to the degree of engagement of the student in the learning process, while the second includes aspects relative to responsibility and fulfillment of his or her learning activities. Therefore, commitment represents students' willingness for participation directed toward learning success achievement (Miller, Rycek, & Fritson, 2011).

Student commitment is considered one of the best predictors of learning and personal development (Carini, Kuh, & Klein, 2006), as well as of academic results (Coates, 2005; Kuh, 2009). The US National Survey of Student Engagement also emphasizes the relevance of commitment, not only as a predictor of academic achievement but also as essential for quality and attainment (National Survey of Student Engagement, 2013).

Committed students are characterized by their active involvement in course activities, and high levels of access to resources (Michinov, Brunot, Le Bohec, Juhel, & Delaval, 2011), as well as autonomy in problem-solving tasks and active participation in teamwork activities (Ibarra Sáiz & Rodríguez Gómez, 2011).