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Rethinking Learning in a Connected Age

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FOCUSING ON UNDERGRADUATES' BEHAVIOUR. LEARNING ANALYTICS IN HUMAN HISTOLOGY

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Abstract

Big data is an emerging field of research and many organizations especially governments, business and health care currently use them to make informed decisions. Millions of generated data are unstructured and come in a variety of formats. Nowadays, data technologies make possible to collect and store large and complex amounts of data and then to turn them into meaningful patterns.

In higher education, there is limited research into big data despite it would bring opportunities to inform decisions and to identify potential issues related to policies, programs, teaching, learning and research.

When learners interact with a digital device (smartphone, tablet or laptop) data about their interactions are easily "logged" and so can be used for further analysis. The trails that students leave behind can be analyzed and could reveal social connections, behaviors, preferences and goals. A large field of research opens to identify patterns and deviations from patterns, addressing some of the key challenges facing higher education.

Spanish Universities have deployed different platforms to support teaching and learning. An important part of the teachers still uses the digital environment as a sort of digital photocopy service. However, some teachers make an advanced use of the virtual campus with tasks, exams, wikis and forums and other activities. The Universidad Complutense of Madrid has started some actions to allow the analysis of the students' interactions and to examine patterns of students' performance. We describe in this paper one of these pilot experiences focused on Human Histology, a subject in the second year of the Medicine Degree. Three are the main aims of this experience. First of all, to propose a working methodology to gather the data, to define the metrics and to set up the indicators that may be useful to identify patterns in the undergraduate students' learning. Secondly, to evaluate the results in order to make better decisions that achieve better outcomes. Finally, to reflect on the metrics and indicators that could be useful to measure in other subjects and knowledge areas.

Keywords: Higher Education, Innovation, Assessment, Management, Student.

1 INTRODUCTION

1.1 Big data and Learning Analytics

Universities and Higher Education institutions are in a complex and increasingly competitive environment. Global changes, declining government funding and growing regulatory demands for accountability together with the convergence of the European Higher Education Area have prompted a debate on how can universities respond efficiently to the new challenges [1].

Basing decisions on data and outcomes seems obvious and research indicates that data-driven decision-making improves productivity [2,3]. Governments, business and health care are jumping on the analytics in order to produce insight into lifestyle and habits of citizens and customers. Nevertheless, institutions of Higher Education have substantial delays in analysing its data [4].

For decades calls have been made for improving quality and efficiency of Higher Education. Big data is an emerging field of research that uses data analysis to inform decisions [1]. Data explosion due to the Internet, mobile devices, cloud computing and learning management systems (LMS) has required new technologies and techniques to be able to manage the deluge of data. It is clear that analytics can provide information to guide the required reforms, that's it, to instruct governments, educational authorities and administrators.

But besides academic analytics, learning analytics should be a key point for faculty and learners. Actually, few lecturers and professors and even fewer students realize that when they interact with a digital device data remain logged and may be available for later analysis [5]. Learning analytics could be applied to examine student entries in a course, in blogs, wikis or forums. Initially, the analysis should be centred on describing student's behaviour and trying to identify possible patterns. Making visible students' performance give way to recognize the diversity of students and opens the possibility for teachers to tailor their teaching and to reduce dropouts and improve efficiency.

1.2 The context

Some Spanish Universities have started some actions to allow the analysis of the students' interactions and to examine patterns of students' performance. At the Universidad de Barcelona the group of Caminal has described different Moodle usage practices by students of Chemistry, Natural Sciences, Early Childhood and Primary Education Degrees [6,7]. At the Universidad Complutense of Madrid (UCM) Hernández *et al.* [8] pointed out that different patterns could be described in Business Statistics' students according to their activity.

Human Histology is a compulsory annual second-year subject of the Medicine Degree at UCM. It extends from September to March and five exams are scheduled together with Human Anatomy and Human Physiology. A final exam is programmed in June for students who didn't pass the continuous evaluation. Teaching is based upon a blended learning approach using a Learning Management System (LMS), in particular Moodle platform. A virtualised space is organised to provide materials such as presentations, bibliography or scripts, and to schedule optional assignments and quizzes to train them. A second space is created specifically for the practical part. Communication between students and teachers also benefits from the virtual campus since tutoring is facilitated with a forum where students are invited to ask as well as to answer any academic question posted by classmates [9].

We present in this paper the first results of the Human Histology' logs analysis, making a description of students' uses in the virtual campus. Data from the virtual space for practical were not included in this study.

2 METHODOLOGY

Data of a group of Human Histology were obtained from two consecutive courses, 2015/16 and 2016/17. The teacher provided some of them, in particular, dates of exams, quizzes and assignments. A confidentiality commitment was followed and an identity code was assigned to each student. Academic and usage data were stored as Moodle logs and were obtained from the eCampus Area. The UCM moved from 2.6 to 2.9 Moodle version in July 2016. This change meant differences in the management of logs, so it has been necessary to refine data to make them comparable. Subsequently they were analyzed with R, a free software environment for statistical computing and graphics and RStudio, an integrated development environment for R.

The types of data gathered were exclusively learners' interaction log files. Quantitative measures chosen were number of total logins in the virtualized course per day, average of the login frequency per each day of the week and per each hour of the day. These data were compared with data of the global Moodle activity at the UCM obtained from Google Analytics (unpublished data). Additionally, the number of entries in resources per day, the number of entries in quizzes per day and the number of forum posts per day were checked.

3 RESULTS

The group was formed by 84 students in 2015/16 and 87 in 2016/16. In the first course, 65.5% were women and the percentage raised up to 74.1 in the second course. In both cases the vast majority of the students were 19-20 years old and enrolled in the subject for the first time.

The number of total logs was 128,829 in 2015/16 and 269,500 in 2016/17. These figures reveal a much more complex activity in this subject that extends over 24 weeks compared with some others published. Hernández reported a total of 14,624 logs in Business Statistics at UCM, a subject taught in the first term during 12 weeks two days per week [8]. Caminal *et al.* found 9,266 and 14,767 logs in different subjects of Early Childhood and Primary Education Degrees taught during 12 weeks [6,7]. A larger amount, 86,435 logs, were registered during the 11 weeks of the course Information and

Communication Technologies in Education at the University of Patras [10]. Nevertheless, preclinical subjects in the Medicine Degree, such as Histology, have got a larger teaching load than other studies and also the academic schedule is more complex. This make difficult to compare them with subjects from other studies.

The number of total accesses was 21,704 in the first course and 46,020 in the second one. Figure 1 represents the number of accesses per day (left, 2015/16 and right, 2016/17). As can be seen in the axis scale the number has hugely increased in the second course. This difference between both courses in the students' behaviour was also observed when measuring the number of entries in resources per day (Fig. 2) and the number of posts per day (Fig. 3). Fig. 1-3 show a green line indicating the average number in each case and red lines indicating the dates of exams. Grey lines represent quizzes dates in Figs. 1 and 2 and forum due dates in Fig. 3.

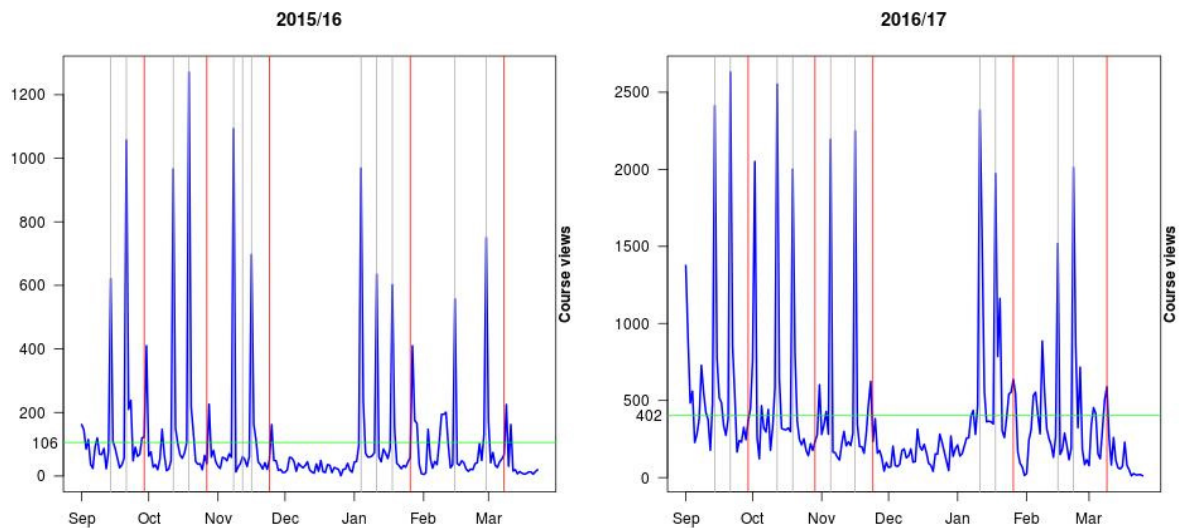


Figure 1. Number of logins per day

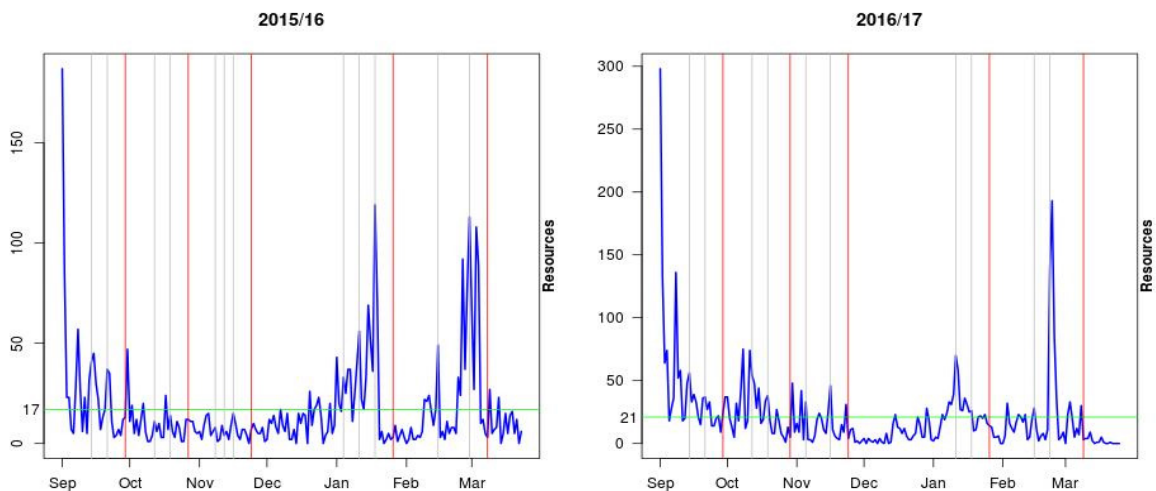


Figure 2. Number of entries in resources per day

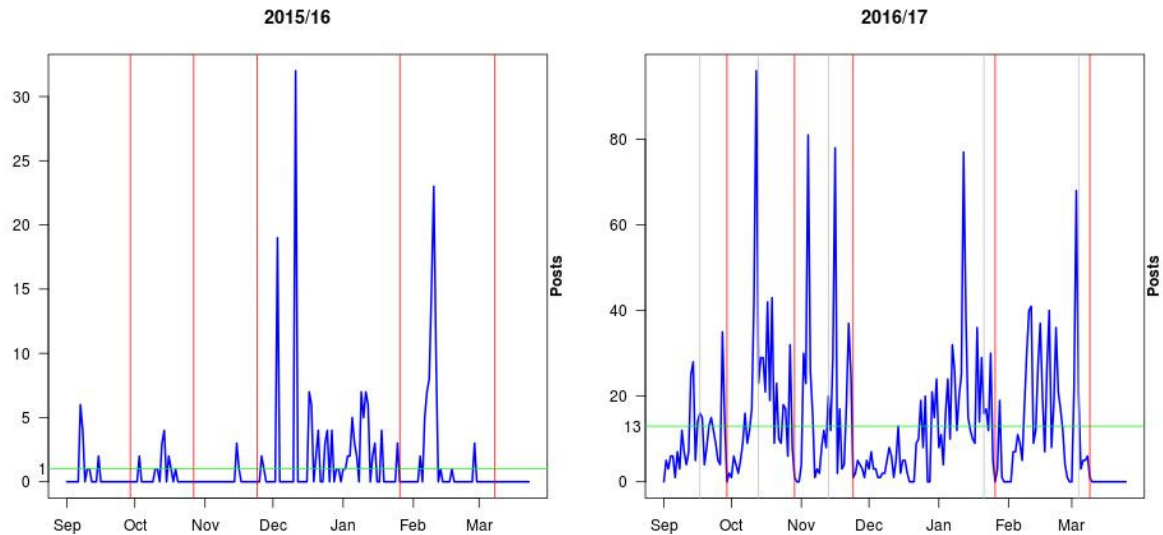


Figure 3. Number of daily posts

A couple of time-based metrics were analyzed in order to find out students' connection habits. To get an insight into the days of the week where students were most active on Moodle, we examined the Moodle logs on a per student basis, measuring and separating out activity across the week. Fig. 4 left shows the distribution of logins per days of the week. Two are the main findings. First, in both courses, maximum values were reached on Sundays and minimum values on Fridays. This contrasts with Google Analytics' data of global Moodle activity at the UCM that show maximum values from Mondays to Wednesdays falling to minimum on Saturdays and with Caminal *et al's* results [6]. And secondly, a clear rest shift from the weekend to Fridays and Saturdays is shown and this agrees with other publications [6,11]. Time activity showed a similar distribution in both courses being the activity values maximum from 22 hours to midnight (Fig. 4 right). Once again, we found that Histology students' behaviour is different from the general one at UCM, where high values are found at noon and at six in the afternoon. Both differences may be due partially to the quizzes' opening time chosen since students were requested to fix dates and time of quizzes and they decided to do them late on Sundays in both courses.

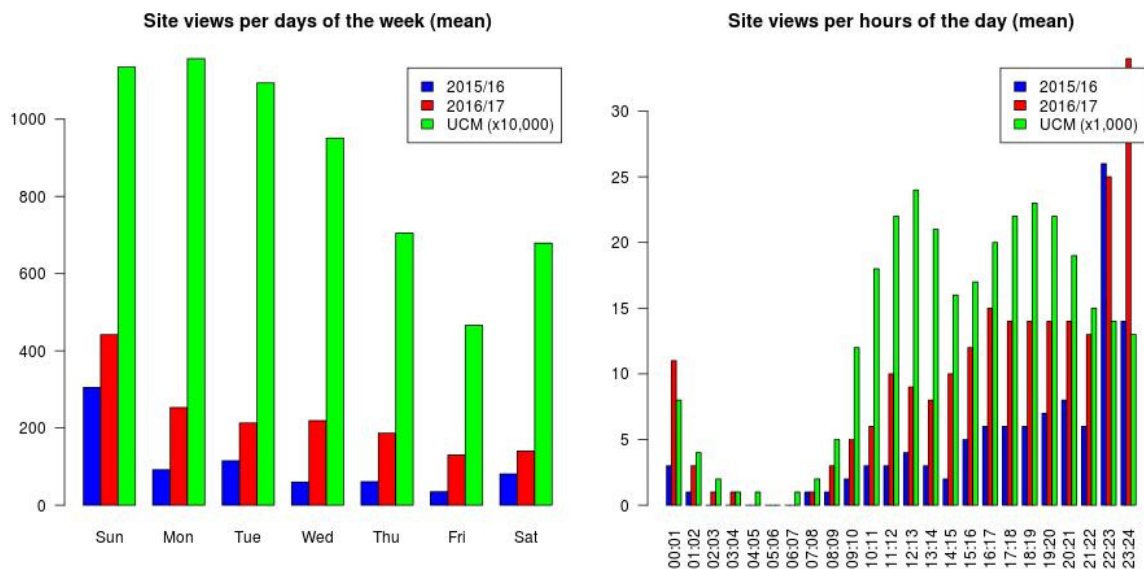


Figure 4. Number of logins per days of the week (left) and per hours of the day (right)

4 CONCLUSIONS

Moodle has attained an enormous popularity over the last decade: Almost 37 million users across 3.7 million courses in 211 countries as of September 2010 [11]. Descriptive analytics aims at describing and analysing historical data collected on students for purposes of understanding and optimising learning and the environments in which it occurs [12]. It also provides institutions of higher education with an opportunity to identify patterns from samples, subsequently giving way to predictive analysis.

Analysis of the Moodle data stored as logs can help teachers to better know the students' activity. In this study, participation was hugely increased in Histology students from 2015/16 to 2016/17. The first group analyzed was formed by students who frequently skipped class and dropped out of the subject until the final exam in June [13]. Although an extra bonus could be get making assignments and quizzes it was not enough to motivate them. In order to improve motivation and participation clinical cases were introduced in lectures and the extra bonus could be get also by solving correctly clinical cases or by forum participation. A clear student satisfaction was found [14] and actually, the analysis of the data proves a massive participation of the students both when measuring total accesses per day or forum posts.

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