Visualising the MOOC experience: a dynamic MOOC dashboard built through institutional collaboration

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Abstract

The Growth of MOOCs is matched by interest into the potential for learning analytics to provide an objective frame to motivate learners and reveal broader insights into learners' behaviours. Visualising live MOOCs data creates the potential to provide a manageable and understandable interface to data to help orchestrate learning and inform subsequent stakeholder decisions. This paper presents outcomes of collaborative work between two European universities investigating FutureLearn platform datasets. the paper used two examples of the dashboard functionality to explains the rationale for the analytical investigations which were performed. One strength of this approach is that it can present analytical data to different institutional stakeholders such as learning designers, educators, facilitators, and administrators.

Keywords

MOOC, Dashboard, Learning Analytics, Collaboration

1 Introduction

Universities offering MOOCs are accumulating large amounts of learner-generated data. Analysing such big datasets can provide invaluable insights to education providers. However, we are warned about the sterile results that such analyses can yield often if they are made in a restricted variety of contexts (Weston, 2012). The increasing use of learning analytics in Computer Supported Education has been widely documented (Baker & Siemens 2013, Siemens 2012, Elias 2011). One of the most salient purposes of learning analytics is that of visualising learner activity so that educators find the assistance they need to make appropriate interventions (Duval, 2011). However, as Reich suggests, "big data sets do not, by virtue of their size, inherently possess answers to interesting questions." (2015). We believe that research resulting from cross-institutional collaboration is key to identifying good practice, systematically investigating learner behaviours, and potentially achieving excellence in MOOCs. The task of raising interesting questions and finding their answers from a position of institutional isolation is an arduous task. The benefits for collaboration, bringing together different views and experiences is particularly significant when it comes to learning analytics.

One of the most important goals for consolidating efforts towards learning analytics is that of achieving a feedback loop to improve the performance of educational products based on learners' feedback (Clow, 2012). This objective motivated our ambition to build a dashboard. The design drew on the assumption within Laurillard's conversational framework that learning occurs as the result of a constant and reciprocal exchange of feedback between learners and educators (Laurillard, 2002). Popular MOOC platforms such as edX and FutureLearn record learner activity data, and provide that data to their consortia's institutions. edX provides a service called Insights, visualising learner activity from different angles. FutureLearn provides curated data to its partner institutions, incorporating demographic data and that resulting from learner activity.

This paper shares insights gathered from a collaborative project between the University of Southampton (UoS) and the University Autónoma of Madrid (UAM). The project objective was to develop a dynamic dashboard that visualises data provided by the FutureLearn platform in near-to-real time. we argue that one of the most valuable purposes of visualising learning activity should be of making the outputs of the data acces-

sible to a broader range of educators so that learning can be orchestrated in response to the evidential behaviours of the cohort or specific subsets of the cohort; concurrently educational stakeholders (planners, managers) may gain a greater insight into the effectiveness and potential optimisations of the MOOCs for which they have oversight.

2 Two Universities, two Platforms

UAM became a member of the edX Consortium in 2014[1] (Claros et.al., 2015). EdX courses consist of weekly sections, which are composed of one or several learning sequences. These learning sequences are composed mainly of short videos and exercises, moreover, they can have extra educational content such as html pages or interactive educational resources. All courses have online discussion fora where students can post and review questions and comments to each other and teaching assistants. edX courses can be categorised as xMOOCs, falling in the behaviourist paradigm where the assessment is based on the completion of exercises. This allows metric measurements of student progress such as that conducted by Colvin et.al. (2014), using Item Response Theory. Such an approach also allows the production of successful completion certificates based on students' performance in the MOOC assessed activities.

UoS, was one of the first FutureLearn partners, joining the consortium in the autumn of 2013[2]. The FutureLearn course structure is similar to that of edX. FutureLearn courses are divided in weeks. Each week contains a set of activities, which in turn contain a set of steps. Each step is composed of a set of learning objects of different types depending on their purpose: videos, articles, exercises, discussions, and quizzes. Each step is linked to an associated discussion board in which the main topic of conversation is meant to be the step content. This architecture reflects FutureLearn's pedagogical underpinnings inspired in social constructivism and Laurillard's conversational framework (Laurillard, 2002; Ferguson & Sharples, 2014). In this paradigm, learning is the result of the social interaction between peers, and the platform is built in order to afford

[1] https://www.edx.org/school/uamx
[2] https://www.futurelearn.com/partners/university-of-southampton

such social interaction. Accordingly the platform data is served to institutions with a structure that specifically supports the study of the social interactions of the learners.

Both UAM and UoS have produced a set of MOOCs with similar structures. Both are divided in weekly modules, both have videos as the main source of input to elicit learner activity, and both record this learner activity. In both cases, the experience of the MOOC can be very similar for a passive learner who exclusively consumes content. However, experience of active learners can manifest quite differently. Learners in UAM with edX are encouraged to frequently and automatically self-assess as they progress in the course, whereas learners in UoS with FutureLearn are encouraged to self-reflect on and comment in the discussion on each step of their progress.

Such difference in pedagogical approaches are reflected in the datasets held by the institutions. Although both are represented in tabular data with common metadata elements such as the timestamp, the learning object, and the learner ID, they are different in some of the information they provide. For example, edX data allows much more detailed analyses of the learner performance in the courses based on how much time they spend in a video or in a task, and the outcome of the automated assessment. That is, the interaction between the learner and the platform. On the other hand, since, in the FutureLearn platform it is easier to ascertain what the topics of such conversations, the data supports far deeper analyses on learners' conversations.

3 The UoS MOOC Dashboard

In the summer of 2015, UoS and UAM embarked on a joint project aimed at realising a cross-institutional and cross-platform analysis of their respective MOOCs data. For this, an experimental dashboard was developed, inspired by lessons learned from the development of the Open-DLAs by the UAM (García, 2015). The new dashboard is in its first phase and it is based on the UoS FutureLearn MOOCs data. The UoS Dashboard was created to dynamically visualise the data provided by FutureLearn. Both the dashboard and the data are securely hosted in the Web Observatory server of the UoS, meeting the UK Data Protection Act of 1998 (JISC, 2013).

The data is obtained via two main sources: surveys and learner activity. Surveys provide intent, satisfaction, and demographic data in csv format. Learner activity provides comments logs, quiz results, step activity, enrolment activity, and peer-review activity. Learner activity data is served in daily updated datasets, also in csv format. The datasets contain metadata such as timestamps for each event, and anonymised author id.

The dashboard was developed under Shiny, an R based framework and R Studio an R-based interface that makes it easy to create interactive web applications directly in R, without the need to write any HTML or JavaScript. This framework offers a number of control widgets such as range sliders and drop down boxes that can be placed in the user interface file.

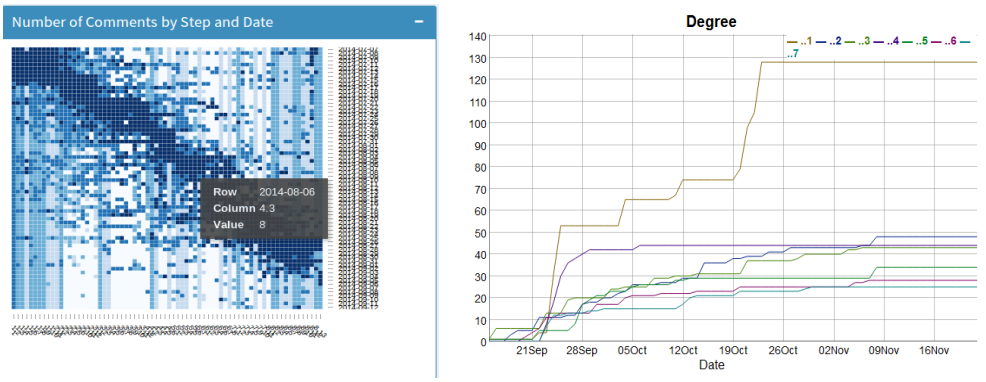

Figure 1. Charts from the UoS MOOC Dashboard.

The dashboard offers a wide range of dynamic visualisations on screen, which provide further information by hovering the mouse on specific areas of the graphs. For example, Figure 1 (left hand side) represents the number of comments made in each step and each date in the MOOC entitled “Developing Your Research Project” (DYRP1). The mouse is placed in a point in the chart that displays a specific date (row), a specific learning object (4.3) and a specific value, visually represented with the darkness of the pixel colour (the value is 8). This representation allows the identification of the participation patterns followed by the learning community. The darker descending line indicates that learners tend to follow the course in a linear sequence. With the dashboard,

all educators will be able to access this chart for their courses without any coding effort, which will allow them to identify not only patterns, but also outliers that may help make inferences about the reactions of the learning community towards the content of the course as it progresses. That offers the potential to become a useful tool for educators in the course to quantitatively assess their learning materials in terms of usage.

Another example is the visualisation of the degree-centrality evolution of selected students (see also Figure 1, right hand side). Based of the previous work of Claros, Cobos and Collazos (2015), we applied Social Network Analysis (SNA) techniques to the DYRP course social network based in the students' activity at the discussions, in order to generate learning analytics visualizations in the dashboard. We wanted to identify the most socially active students in a course and to track their evolution in the course's social network taking into account the incremental growth of their connections in the network. In this case we generated a visualisation with the evolution of the Degree Centrality of these students. This analysis and visualisation could potentially assist facilitators who want to enhance the connectedness of the learning communities in MOOCs, as suggested in Leon-Urrutia et.al. (2015).

4 Conclusions and Future Work

Building tools for visualising learners' behavioural footprints in MOOCs is a difficult task if looked from one single angle. Collaboration between different institutions with different experiences can provide a wider visual field with which deeper and broader analyses can be conducted. In this paper, we have reported the development of The UoS MOOC Dashboard, a MOOC visualisation suite jointly developed by the UoS and the UAM. The participation of representatives from both institutions in the development process has been mutually beneficial, building expertise that can be transferred to their respective institutions and learning technology teams.

Tool like the MOOC Dashboard render both up-to-date and historical information on how courses are progressing. The choice of the aspects to be visualised has been made from the awareness of different educational paradigms with which the two collaborating institutions were working, both through their institutional traditions; and the MOOC platform consortia to which they belong. The result has been a dashboard that

looks at the student progress from two key perspectives: learners' social interactions and learners' performance. The inclusion of demographic data in the mix can help educators and course designers make decisions based on their target audiences. However, perhaps the most significant potential outcome of this dashboard is that of making MOOC learner data available to a wide range of educators. Drawing on Reich (2015), although big datasets themselves cannot guarantee to answer interesting questions, perhaps making big educational datasets available to educators through visualisations to can help generate interesting questions, and assist in finding their answers.

The MOOC dashboard is designed for use by all those involved in the development and delivery of the courses. As future work, it is intended to assess the usability, the impact, and the validity our tool. We will study the interactions of the end users, survey their satisfaction and usage patterns and calibrate the dashboard measures to review its theoretical robustness. This usage data will be gathered both actively and passively. That is, hooks will be installed in the application that will provide metrics of usage of different elements of the dashboard, and surveys will be distributed to end users for self reflection on the use of such a tool.

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