

# The role of learning design and learning analytics in MOOCs

## Citation for published version (APA):

Brouns, F., & Firssova, O. (2016). The role of learning design and learning analytics in MOOCs. In A. Volungeviciene, A. Szcs, & I. Mázár (Eds.), *Conference Proceedings of the 9th EDEN Research Workshop: Forging new pathways of research and innovation in open and distance learning: Reaching from the roots* (pp. 329-336). European Distance and E-Learning Network.

## Document status and date:

Published: 01/10/2016

## Document Version:

Peer reviewed version

## Document license:

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## THE ROLE OF LEARNING DESIGN AND LEARNING ANALYTICS IN MOOCS

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### Summary

The last couple of years there has been a lot of attention for MOOCs. More and more universities start offering MOOCs. Although the open dimension of MOOC indicates that it is open in every aspect, in most cases it is a course with a structure and a timeline within which learning activities are positioned. There is a contradiction there. The open aspect puts MOOCs more in the non-formal professional learning domain, while the course structure takes it into the formal, traditional education domain. Accordingly, there is no consensus yet on solid pedagogical approaches for MOOCs.

Something similar can be said for learning analytics, another upcoming concept that is receiving a lot of attention. Given its nature, learning analytics offers a large potential to support learners in particular in MOOCs. Learning analytics should then be applied to assist the learners and teachers in understanding the learning process and could predict learning, provide opportunities for pro-active feedback, but should also results in interventions aimed at improving progress.

This paper illustrates pedagogical and learning analytics approaches based on practices developed in formal online and distance teaching university education that have been fine-tuned for MOOCs and have been piloted in the context of the EU-funded MOOC projects ECO (Elearning, Communication, Open-Data: <http://ecolearning.eu>) and EMMA (European Multiple MOOC Aggregator: <http://platform.europeanmoocs.eu>).

### Setting the scene

MOOCs currently receive a lot of attention, although it is not always clear to what purpose MOOCs are being exploited. Literature does not provide a clear picture on this yet. Sometimes universities make MOOCs available as a form of advertisement and to attract students. On other occasions, teachers and professors run MOOCs to gain more personal exposure (Evans & Myrick, 2015). In some cases, universities experiment with MOOCs to innovate their online environments or pedagogies (Kiers & Jorge, May 2015).

MOOCs, defined as Massive Open Online Courses, open in every aspect, available for anyone, for free, are still considered to be courses. The last letter C for course implies a set structure and a timeline within which learning activities are positioned that could be seen as a contradiction to the other dimensions, massive, open, and online. The latter dimensions would position MOOCs much more as a non-formal learning opportunity, continuous or professional development of lifelong learning instead of teacher driven approaches of formal education courses.

Another big trend is the move towards big data, datamining and analytics. In educational context often referred to as learning analytics, even if these techniques are being used in different domains or being applied for different purposes. The aim of learning analytics should be to provide

information about the learning process to the various stakeholders involved in education and learning (Greller & Drachsler, 2012). When directed at learners, learning analytics in combination with visualisations in learning analytics dashboards could provide valuable learning support to learners (Ferguson & Shum, 2012). For example, it can provide progress information and other individualized support in a MOOC setting where a teacher is not able to provide the individual attention that can be given to students and learners in traditional education or even online education (Brouns et al., 2015). For teachers, learning analytics offers aggregated views over learning process, indicating overall progress and performance. Moreover, results could feed design improvements (Lockyer, Heathcote, & Dawson, 2013).

At the same time, this particular use of learning analytics positions MOOCs away from non-formal learning as it tends to put too much focus on progress, performance and drop-out, characteristics that are important in formal education, but less so in non-formal learning contexts in which the learner determines personal learning goals.

Often learning analytics is being implemented without a proper underlying model or without having a clear idea of its purpose. It then can easily turn into a hype: “let's do this because everybody else is doing it, and let's start collecting data and see what we can make of it”. Even if this can be a valid approach in the big data, datamining or computer science domains, because their main aim is often the development and testing of algorithms and determining patterns, in a learning context it should be developed and implemented with more care, even if only because of ethical reasons and confidentiality of data.

Having said this, learning analytics could potentially fulfil a valuable role in online learning and MOOCs when certain conditions have been met.

In this paper we would like to make two claims. First, a MOOC needs to be designed to cater for its heterogeneous learner population, and offer sufficient flexibility to allow potential learners to reach the desired learning gain (Brouns et al., in press; Kalz & Specht, 2013). In doing so, the most appropriate pedagogical approaches need to be chosen to allow teachers and tutor teams to support the learners in a most efficient and effective manner, without the personalised instruction and feedback common in formal education. Second, dependent on the instructional design and pedagogical models chosen, a learning analytics approach should be thought-through and designed in conjunction with overall MOOC design. We will show several examples of various pedagogical approaches that are based on our experiences in online distance teaching in higher education and in MOOCs. Our evaluation of these approaches led us to extract characteristics that are suitable for a MOOC context. These approaches have also been piloted in MOOC designs in the context of some of the EU funded projects we participate in, such as EMMA (European Multiple MOOC Aggregator: <http://platform.europeanmoocs.eu>) and ECO (Elearning, Communication, Open-Data: <http://ecolearning.eu>).

## **Learning design approaches for MOOCs**

### ***A task-centred approach***

The educational approach followed by the Open University of the Netherlands in its open online learning is based on active learning design principles that are aimed at optimising learners' learning experiences and performance. Learning design principles are applied to activate and engage learners

through meaningful learning tasks and activities that are anchored in the state-of-the art in the domain and have professional relevance for participants.

In order to cater for a broad target group of professionals of varying expertise levels, with different learning needs and time available for learning, MOOC design includes tasks of several complexity levels. At basic level, learning tasks integrate introductory learning activities with activities that stimulate learners to interact with the content and with each other reflecting on relevant practice-based cases, linking the new theoretical knowledge acquired in the course with their own practice and with the shared experiences of other MOOC participants.

In addition, advanced level learning activities are offered to stimulate professionals of higher expertise levels or those who can afford spending more time on learning, to study. Advanced level activities can be optional. All learning activities are offered in an online learning environment providing affordances for the interaction and knowledge sharing.

As an alternative for individualized teacher feedback on performance and progress, participants are invited to generate ideas, challenges or questions for the experts and share their ideas or challenges in the environment so that experts and tutors can respond in a one-to-many way either through online video broadcasts or through blogs and online discussions.

These design principles have been put into practice in various non-formal learning opportunities, such as masterclasses and MOOCs offered by the Open University of the Netherlands (Firssova, Brouns, & Kalz, 2016; Kalz & Specht, 2013). The design principles have been piloted in MOOCs in the EMMA project and can be extended to different MOOC contexts.

### ***A social and inclusive approach***

The ECO project is developing an architecture integrating several different MOOC platforms to provide ubiquitous access to MOOCs. One of the first actions was to develop a pedagogical framework for MOOCs that aligns with the European take on educational design classified as sMOOCs. sMOOCs are 'social' since they provide a learning experience marked by social interactions and participation, and 'seamless', since ideally they should be accessible from different platforms and through mobile devices and integrate with participants' real life experiences through contextualisation of content via mobile apps and gamifications.

By intention the pedagogical framework has been developed as a framework and not as a model because it needs to allow flexibility in approach and cater for the various needs of the learners. In particular, the learner is put central and the MOOC design should allow learners to learn by doing, learn through performing activities in a situated context, in interaction with content and other learners. Flexibility allows learners to choose their own learning path. The pedagogical approach is based on constructivist and connectivist learning principals, situated learning, and learning enhanced through gamification and mobile learning approaches (Brouns et al., in press).

### **Learning analytics**

There is not, yet, a single definition of learning analytics. The first international Conference on Learning Analytics and Knowledge 2011 (<https://tekri.athabascau.ca/analytics/>) defined learning analytics as "The measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it

occurs". This definition already hints at supporting the learning process, although still a teaching perspective.

Learning analytics should be providing support to the learning process and there should not only be gathering data, but also define suitable metrics that allow interventions to take place (Clow, 2013). Often indicators and metrics rely on measures of activity levels (i.e. frequency) that do not allow meaningful interpretation unless these are related to the learning design and learning theory (Gašević, Dawson, & Siemens, 2015). Indicators are often used as predictors of learning success and visualised in learning analytics dashboards. When the indicators are not followed up by correct interventions, either by the learner or the teacher, the learning analytics fails in supporting the learning process. Therefore not only the quality of the visualisations is very important; the visualisations should be intuitive and easily understandable, learners and teachers should be able to extract relevant information and be guided in the interpretation of this information in relation of their learning process. Furthermore, it is important that a correct interpretation is followed by suitable actions and interventions (Gašević et al., 2015; Verbert et al., 2014).

### ***Challenges for learning analytics in MOOCs***

The 'open' dimension of MOOCs often means that there is no information about the background of the learners, or their learning objectives, making it difficult to measure learning progress. While the constraints in formal education are clearer, in MOOCs learners determine the learning opportunities on their own. Learning analytics has to focus much more on determining and supporting the on-going learning processes. The role of learning analytics should then be much more in raising awareness of these processes, assisting in reflection and monitoring of the progress and motivating to take the correct action, both for learners and teachers.

In a MOOC the role of a teacher is much more that of monitoring instead of offering direct and personalised instruction and feedback. Course designer and teacher rely on other forms of feedback, usually based on one-to-many feedback mechanisms or they have to rely on learners helping each other. Learning analytics should assist in tracking and visualising this process to allow the teacher and learner to assess the effectiveness of the process and signal specific situations that require (teacher) intervention.

### **Aligning learning analytics with MOOC design**

Learning analytics approach realized in the EMMA MOOC platform illustrates both the possibilities and the caveats of using learning analytics when the integration with design is limited.

The EMMA platform provides learning analytics dashboards to both MOOC teachers and learners. Learner dashboards inform the learners on their progress in the MOOC that they follow, visualizing the proportion of lessons completed and /or learning activities undertaken by the learner, as well as the numbers of assignments and quizzes completed successfully, materials read or downloaded. EMMA MOOCs do not have to conform to a particular pedagogical approach or instructional design. However, the EMMA platform sets a fixed course structure, consisting of lessons, units and assignments. Therefore progress can be indicated along that course structure. The learning analytics approach in EMMA is only at high level linked to learning theories, in that it does assume learning requires interaction with content and others. Therefore, in addition to analysing frequency of interactions, sequences and patterns of interactions are considered. By interacting with others,

learners demonstrate uptake of knowledge and learning (Stahl, 2006; Suthers, Dwyer, Medina, & Vatrappu, 2010) and this is in EMMA operationalised by the conversations and blogs. Social and artefact networks illustrate how learning material is being used and what networks evolve around them (Tammets & Brouns, 2014). Furthermore, the dashboard allows an individual learner to compare his or her progress to that of fellow learners. Figure 1 is an exemplary representation of the learner dashboard in an EMMA MOOC.



Figure 1: Part of an exemplary representation of a learner dashboard in EMMA

Learner dashboards realized in EMMA are not integrated in the instructional design, other than providing a general course overview. If such integration took place, learners' decisions what lesson to follow could be influenced by overviews of behaviour of others as can be seen in learning networks when learners determine the most successful learning route by looking at routes taken by others (Tattersall et al., 2008). Similarly, overviews of tasks that attracted others or were avoided by them could have helped learners to make conscious choices.

For teachers aggregated views are presented to give teachers a quick overview on learning activities accessed and assignments submitted. Time on task is often considered to be a measure of learning and the teacher learning analytics dashboard provides an indication of time spent and number of interactions in each of the lessons (see Figure 2 for an example of a teacher dashboard).



Figure 2: Exemplary representation of the teacher dashboard in EMMA

Contrary to EMMA, ECO sMOOCs adhere to a pedagogical framework of social, seamless inclusive MOOCs based on constructivist and connectivist principles. The pedagogical approach supports independent learning and is learner-centred. Through interaction with others and with content learners re-appropriate and recreate content, produce their own content, establish interconnections and interpersonal relationships, get and receive feedback, experience different perspectives and

engage in the dialogue with others, which fosters real individual knowledge acquisition but also a shared construction of knowledge in a social context.

To this purpose, the metrics in learning analytics are connected to the goals of the learning activities. Learners are expected to stand still and understand the purpose of the learning activities, the characteristics of what the course designer or teacher expected in relation to their participation in the proposed activities, and how learning analytics provided serve as a representation of this. Thus, learners are encouraged to set personal goals for their participation and to use the analytics to help monitor these. One of the key attractions of learning analytics in ECO is the possibility to support the learner in actively reflecting on and taking action to manage their learning process.

However, the implementation of suitable learning analytics is quite complex. The pedagogical approach is flexible, but can also be implemented in many various ways. Therefore there is not a fixed course structure and every course could be designed differently. Furthermore, ECO aggregates multiple MOOC platforms and each of these platforms provides different mechanisms to implement the pedagogical approach, complicating learning analytics even further. Solutions need to be found to inform the learning analytics not only of course structure but also of course and pedagogical design.

Research indicates that MOOCs have different categories of learners, ranging from those who browse a little to those intending to do the complete course aiming for a full certificate. These categories of learners differ in their level of engagement with the course materials and learning activities to meet their personal learning goal. Learning analytics should take that into account and support the learning goal of that particular category.

### **Acknowledgements**

Part of the work reported here has been carried out in the context of the EU CIP funded projects ECO (grant agreement n° 621127) and EMMA (grant agreement n° 621030) and we would like to thank all partners involved for their contributions in the projects.

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