

## Developing a pedagogical model for a massive open online course (MOOC)

David Robinson<sup>1,\*</sup> and Patricia Ash<sup>2</sup>

<sup>1</sup> Department of Environment, Earth and Ecosystems, The Open University, Milton Keynes, MK7 6AA, UK

<sup>2</sup> Science Faculty, The Open University, Milton Keynes, MK7 6AA, UK

For correspondence: [david.robinson@open.ac.uk](mailto:david.robinson@open.ac.uk)

**Abstract :** MOOCs are a new phenomenon in higher education and have the potential to change both student behaviour and design of courses. However, at present MOOCs are still in the experimental stage and it won't be clear for some time if they are a short-term but passing phenomenon or the engine of a revolution in higher education. We have been involved in developing and presenting a MOOC that provides an introduction to ecosystems and report here on the model we used to both engage learners in the subject and retain their interest throughout the 6 weeks of the course.

**Keywords:** MOOC, online, open, ecosystem

### Introduction

The Massive Open Online Course, colloquially known as a MOOC, is a relatively recent educational model, being introduced in 2008 by the University of Manitoba as an online course called 'Connectivism and Connective Knowledge'. The course enrolled 100 times more participants than expected (Stephen Downes, quoted in Parr, 2013). However, it was not until 2011 that MOOCs began to attract substantial interest in the global Higher Education community. In that year Stanford University offered a free online course on artificial intelligence and it attracted 160,000 students from across the globe, of whom a staggering 23,000 finished the course (Waldrop, 2013). MOOCs had become a phenomenon and the New York Times declared that 2012 was 'The year of the MOOC'.

MOOCs are available from a variety of sources and in a variety of types. For example, the commercial company, Coursera, offers over 600 free courses from more than 100 partners, although other services generate income. Udacity offers both free and subscription courses. Edex is a not-for-profit company offering free courses. FutureLearn, a private company owned by The Open University, currently offers a range of free courses from over 20 partners, including UK and international universities and institutions such as the British Museum (Universities UK, 2013). There is no standardisation in the type of course that carries the label MOOC and although two types are broadly defined (Daniels, 2012), there is much variation in the courses that fall within these categories.

We have been involved as the Educator (DR) and Facilitator (PA) for the first MOOC offered by our university on the new FutureLearn platform. In designing and presenting this course we had to develop an educational model that was suitable for the material that we wanted to present. In this paper we describe the principles behind the design and the lessons learnt from both a pilot presentation and the first presentation of the full course. *Introduction to Ecosystems* was presented between mid-November 2013 and early January 2014, with a break for Christmas. We discuss the initial results of the evaluation, including the reaction of learners to the content and the extent to which they engaged with the learning.

## Educational design

*Introduction to Ecosystems* is a free course intended to be studied over a six week period with a planned workload of 3 hours study per week. Each week is composed of a number of steps, varying across the six weeks between 7 and 22. Each step is a single browser page containing one media item (image, diagram, audio track of video clip) and supporting text. Steps can serve a number of different educational functions, as described below. The design of each step was dictated by the need for it to be available to users of tablets and mobiles as well as laptop and desktop computers.

### *Audience*

A higher education course designed to fit into a qualification pathway can make assumptions about the entry and exit behaviour of its students. A MOOC designed for open and distance learning across the globe is serving a very wide audience and this has a substantial influence on the pedagogic design. In this particular course the examples of ecosystems chosen had to be as international as possible and any activities needed to be accessible to anyone likely to register for it. There is a tension between providing a low barrier to entry and providing sufficient depth to satisfy learners with previous knowledge of the subject area.

### *Key attributes*

At the start of production five key attributes were identified that the learner would associate with the experience of studying the course. These are shown in Table 1. Of the five, the principal one was the final one, 'thought-provoking'. An over-arching aim of the course was to encourage learners to think about the subject, to engage with other learners in discussion and participate in peer-learning.

**Table 1.** The key attributes of the course

Attribute	Characteristic
Personal	Gives a feeling of addressing the personal interests of the learner
Dynamic	Exciting and varied materials and experiences
Current	Right up to date and dealing with the latest issues
Authentic	Provides contact with the research scientists whose work is featured
Thought-provoking	Encourages reflection and discussion

### *Learning outcomes*

The learning outcomes devised for the course were refined during production and increased from six to seven as an activity involving identification was developed. Assessment on the FutureLearn platform is by multiple choice questions and the learning outcomes were tested at the end of each week, in so far as it was possible with an automated system. As the FutureLearn platform develops, the assessment module will provide greater opportunities for assessing the learning outcomes effectively.

**Table 2.** Learning outcomes

When you reach the end of the course you will have explored the concept of an ecosystem and:	Developed in Week
1. be able to define an ecosystem	1
2. understand the different ways in which a system can be analysed	1 and 2
3. use your knowledge of the key features of ecosystems to determine interrelationships between organisms in a simple ecosystem	1 and 2
4. describe adaptations shown by animals to extreme desert and polar environments	3
5. have joined the iSpot community and obtained identifications for animals, plants or fungi you have seen	4
6. been able to discuss how small organisms in marine systems contribute to energy flow through ecosystems	4
7. explain how humans impact on three examples of fragile ecosystems.	5 and 6

### *Motivating learning*

Three types of step were inserted at intervals in the weeks to promote active learning. To encourage reflection on what had been learnt a step was included which had one or more questions. The questions were not answered specifically in the course but were intended to get the learners to think about the issues that the question raised and to offer comments in the forum for that section. This example followed an audio track and a video sequence about the study of krill in the Antarctic.

*What is the role of krill in the Antarctic food chains? How do the food chains in the polar seas compare with those introduced earlier by Professor David Streeter in the oak wood?*

This particular reflection step generated 201 comments or answers, some substantially longer than this example response.

*The Antarctic food chain is very short and the Krill play a very important part of this. They feed on the phytoplankton and algae and it in turn are prey for a variety of marine life including the blue whale. The Oak wood has a number of interrelated food chains that can have long and often intertwined strands between the basic vertebrates and higher herbivores.*

A second motivating step was a discussion step. There were 14 such steps spread across the weeks which provided a moderated discussion forum around specific questions. An example in the final week was the discussion of the Galápagos archipelago, where three areas for discussion were given.

*Bearing in mind the definition of an ecosystem that you encountered at the start of this journey, is it reasonable to regard the whole archipelago as an ecosystem? What tensions arise between keeping the islands pristine, allowing visitors and allowing colonisation from the mainland? What major threats to the integrity of the habitats on Galápagos can you identify and are they peculiar to the islands or applicable to ecosystems in general?*

The third motivating step was one that encouraged the learners to take part in an activity involving interaction with both the natural world and their fellow learners. There was only one of these activities programmed, as a fair amount of time was needed to complete it.

*In this practical activity you are encouraged to go and look at animals, plants or fungi in a habitat that is easily accessible to you, photograph them if you can, and use the iSpot website to get help in identification.*

iSpot is a website aimed at helping people identify anything in nature. Once registered, they can add an observation to the website and either suggest an identification or see if anyone else can identify it. There are a lot of experts who are part of the iSpot community and help with identification. The aim of this activity was to encourage learners to engage with the practical aspects of studying ecosystems and appreciate the importance of accurate identification.

### *Providing support for learners*

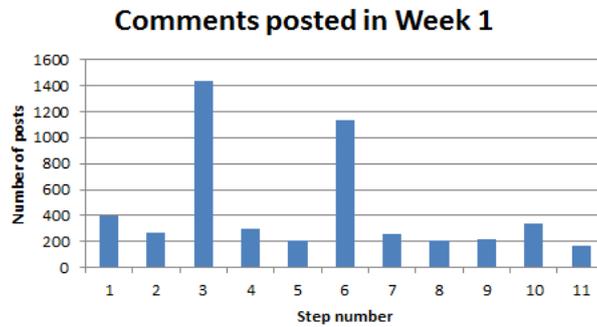
Four facilitators were appointed to support the educator. Every discussion step had a single facilitator whose task was to seed the discussion, intervene to keep it on track, if necessary and to answer questions raised by learners. In addition there were two opportunities to ask questions directly. A polar scientist ran an asynchronous question and answer session at the end of the third week and then during the final week there was an opportunity to ask the educator questions in a one hour live session broadcast using Google Hangouts. The session was also recorded and made available on YouTube. In addition there was a Twitter stream and a Facebook page.

### **The first presentation**

A full evaluation of the first presentation of *Introduction to Ecosystems* is being carried out and it will take some time to complete. The results of an initial evaluation of the participation of learners in the course are presented here.

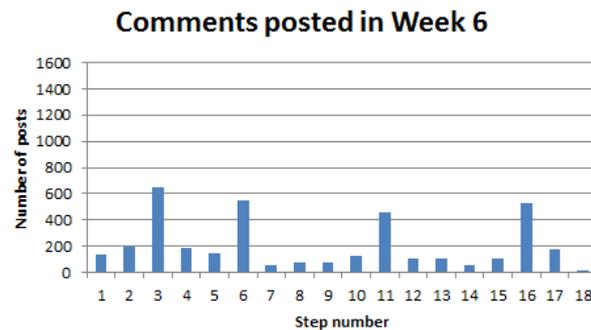
*Forum comments*

Each step provides an option to comment. Based on the experience gained from the 3 week pilot, it had been expected that the majority of comments would be made in the formal discussion steps described above. In fact the number of comments posted was far higher than anticipated and after the first week a facilitator was specifically allocated to moderate these steps. The level of activity on each of the 11 steps in the first week is shown in Figure 1.



**Figure 1.** Comments for each step in week 1. Peaks at steps 3 and 6 relate to discussion steps.

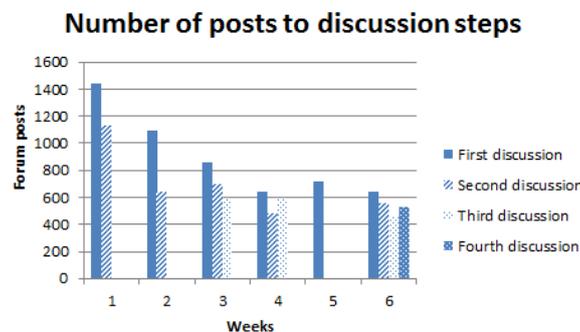
Although the number of comments declined over the course, the final week still had significant numbers of learners posting comments (Figure 2).



**Figure 2.** Comments for each step in week 6. Peaks at steps 3, 6, 11 and 16 relate to discussion steps.

*Formal discussion steps*

The number of formal discussion steps varied each week between 1 and 4 and the number of postings to each discussion ranged from 463 to 1437 (Figure 3).



**Figure 3.** Posts to discussion forums in each week.

The educator and facilitators between them made over 500 posts to the forums, which are included in the above figures. The total number of posts was just over 20,000.

### *The iSpot activity in week 4*

Over a fifth of those who registered for the course also registered with the iSpot website and a substantial number of observations were posted on the site. Around 900 observations were posted using the course tag but the level of activity during the period of the course suggests that this figure is an under-estimate and that not all learners tagged their observations.

## Conclusions

Designing a MOOC is not simply a question of scaling up what you already do for traditional sized classes, to accommodate tens of thousands. As the initial analysis of the Ecosystem course shows, if you can generate enthusiasm, the level of engagement in forums is very high, but the level of activity becomes increasingly difficult to manage. It is impossible to respond to each learner query and the viability of forums depends upon the active help given by the learners as a community. That this co-operation in learning is of value is beyond doubt but there are some negative aspects to the high figures. At first sight, the figures look like clear indicators of success. However, there is a decline in activity as the weeks progress, which might be expected, but there is evidence from individual postings that the scale of comments provides a barrier to learning, as there is no time to read through all of the posts in a thread. The volume of postings also makes it difficult to find relevant information. The volume also has an impact on the facilitators who have to try and keep pace with the postings. The initial analysis of numbers here is a straightforward numerical approach that says nothing about the quality or subject matter of each posting. That awaits a much deeper analysis. Factors that influence decline in forum activity with time have been investigated recently in forums on Coursera MOOCs (Brinton, et al, 2013). The authors show that the active participation of teaching staff in forums increases the volume of discussion but does not slow the decline rate.

At the start of the course learners were told that: ‘...throughout this course you will be considering these overarching questions: What is the importance of understanding ecosystems, how do they work and how crucial is their conservation?’ The evidence so far suggests that *Introduction to Ecosystems* stimulated a large number of learners to sign up for – and complete – the MOOC. The pedagogical model developed for it motivated engagement and discussion. However, MOOCs of this type are still in the experimental stage and although evaluation is ongoing, even the initial evaluation of this MOOC shows that there are problems yet to be resolved when such massive numbers are enrolled on an online course.

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## References

- Brinton, C. G., Chiang, M. Jain, S., Lam, H., Liu, Z. and Wong, F. M. F. (2013) Learning about social learning in MOOCs: From statistical analysis to generative model. *aiXiv: 1312.2159v2 [cs.SI]*
- Daniels, J. (2012) Making sense of MOOCs: Musings in a maze of myth, paradox and possibility. *Journal of interactive media education* 2012/18
- Parr, C. (2013). Mooc creators criticise courses' lack of creativity. *Times Higher Education*. 17/03/2013. Retrieved 25 March 2014
- Universities UK (2013) Massive open online courses – Higher education's digital moment? London, Universities UK.
- Waldrop, M. M. (2013). *Campus 2.0*. *Nature*, 495(14/03/13), 160-163.