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Understanding Massive Open Online Courses

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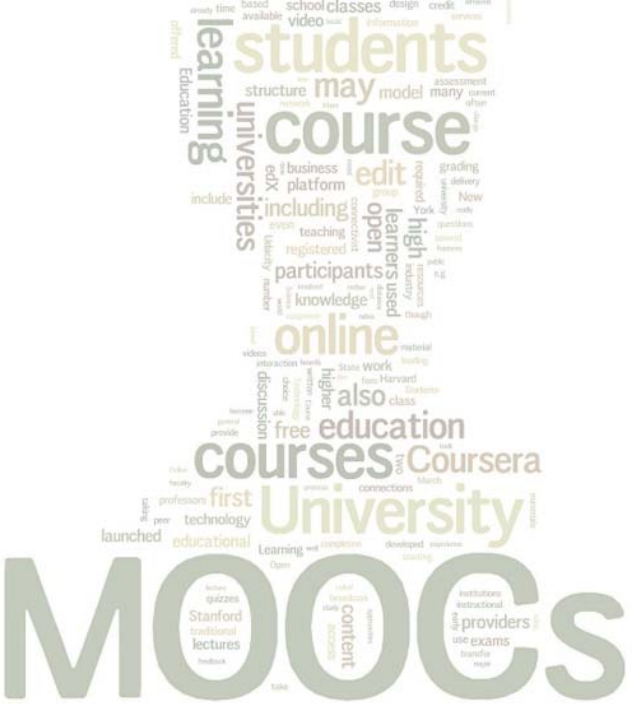
What is a MOOC?

> "The most profound impact of the Internet… is its ability to support and expand the various aspects of social learning… Attention has moved from access to information towards access to other people"
>
> *- (Brown & Adler, 2008)*

In a critique of online learning in 2008, Brown observed that the 'Open Educational Resources (OER) movement' – the network of people who support the development and embedding of a culture of open sourcing, open resources, open knowledge, free sharing and peer collaboration in society – have assembled building blocks that allow the emergence of 'open participatory learning ecosystems'.

This assemblage includes different types of resources that are part of the effort to extend and eliminate barriers of entry into university-level education. The most visible manifestations of these building blocks are Open Educational Resources (OER), OpenCourseWare (OCW) and Massive Open Online Courses (MOOC):

- **Open Educational Resources** are digital materials that can be used, re-used and repurposed for teaching, learning or research. These resources are made freely available online through open licenses, such as Creative Commons. Most OER have been designed to be used by teachers or instructors for teaching (Falconer et al, 2013). However, an intensive area of use of OERs is by learners themselves.
- **OpenCourseWare** are course resources that are openly available free of charge from universities. The first major OCW initiative was started at MIT in 2001. Now many universities make their course resources available to teachers and learners around the world.



- **Massive Open Online Courses** (MOOC) is a course aiming at large-scale interactive participation and open access via the web. MOOC differs from OCW and OER in that it opens up opportunities for learners to participate in learning activities, rather than making resources or courseware openly available.

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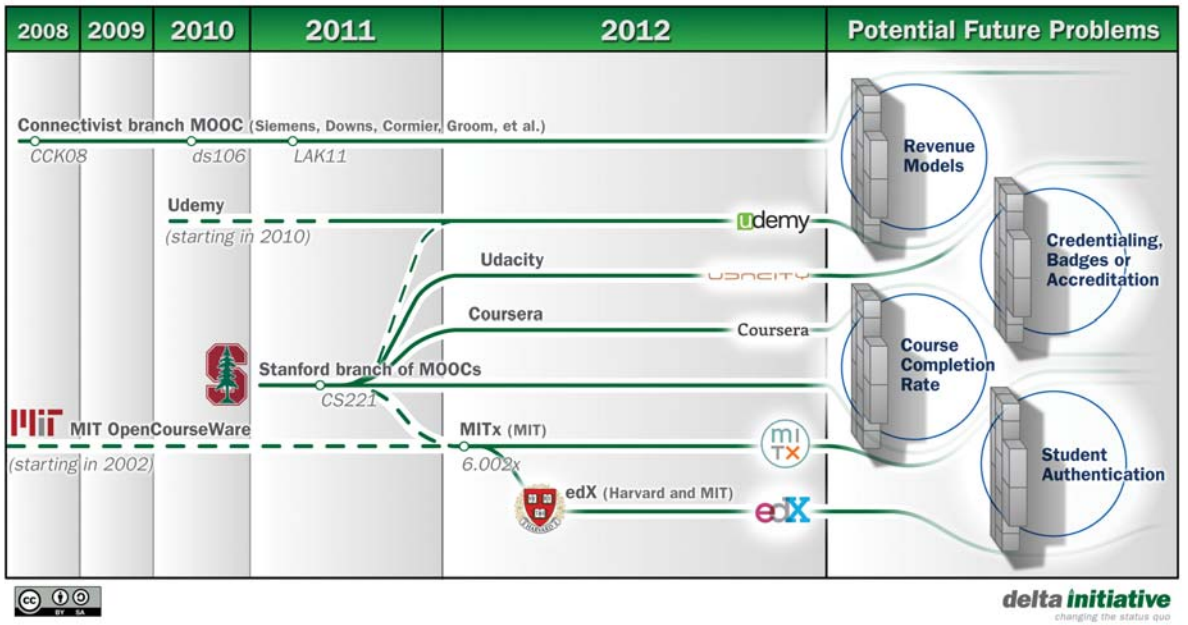
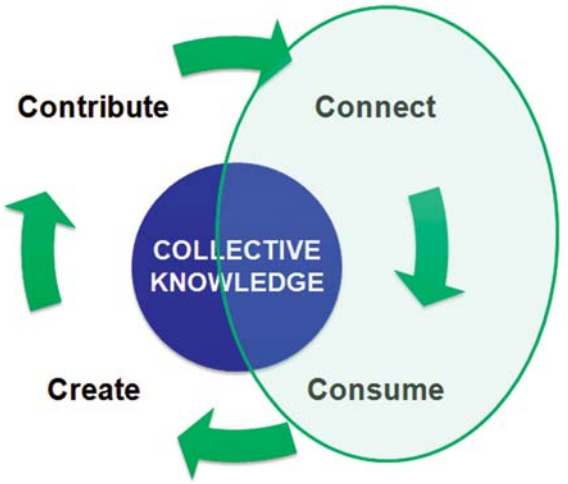
The idea of a MOOC originated from the Open Educational Resources movement. The central idea was to make Open Educational Resources freely available and to run Massive Open Online Courses. MOOCs would encourage learners to use these materials, by connecting with OERs and with other people who were also learning (Daniel, 2012). The design of the MOOCs were based on an approach to networked learning, termed connectivism (Siemens, 2005). The term MOOC was coined in 2008 during a course on "Connectivism and Connective Knowledge" run by Canadians George Siemens, Stephen Downes and Dave Cornier (CCK08, 2008; Downes, 2008). This course was designed and run for 25 fee-paying students, but 2300 others joined in the course for free, participating by using a range of social media tools they had chosen, including RSS feeds, blog posts, virtual worlds and synchronous online meetings. You can view the Connectivism and Connective Knowledge course at http://cck11.mooc.ca/



How are MOOCs designed?

MOOCs attract a wide variety of learners with a range of backgrounds, previous experience and skill levels. Yet there is little empirical evidence on how to design a learning environment that accommodates diverse learner profiles. Generally MOOCs fall into two broad categories: the xMOOC and cMOOC. The first MOOC was established in 2008 and followed a 'connnectivist' pedagogy approach. However, most MOOCs are instructivist by design.

xMOOCs follow an 'instructivist' online course design in which learning goals are predefined by an instructor, learning pathways structured by environment and learners have limited interactions with other learners. One example is the MOOC in Artificial Intelligence first offered in by Sebastian Thrun, a Professor of Computer Science at Stanford University, a former Google executive (https://www.ai-class.com/). The MOOC followed a conventional design in which students who had signed up for the course went through a step-by-step process of watching video lectures, carrying out short tasks, completing computer marked assessments, progressing to the next stage. In some ways the course design is applicable to the subject area - Artificial



xMOOCs

Intelligence is a mathematically based subject with 'right' and 'wrong' answers that can easily be marked through computer aided assessment. Students who completed the course were awarded a Stanford Certificate. Even though this certificate is not viewed as equivalent to a campus-based Stanford qualification, the Stanford 'branding' helped to attract around 100,000 students to the first course. The success of the first AI MOOC motivated Sebastian Thrun to set up a commercial MOOC platform, Udacity (https://www.udacity.com). Around the same time (2012) another commercial MOOC platform was opened, Coursera (https://www.coursera.org).

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cMOOCs

cMOOCs have a different purpose and origin. These MOOCs are based on a different set of design principles, known as 'connectivist'. A basic premise of connectivism is that learners connect through digital networks to learn (Siemens, 2005). cMOOCs differ from xMOOCs in that learning goals tend to be defined by learner (rather than the teacher), learning pathways are open and ill defined (rather than being set within a bounded environment) and interaction with others is expected but has to be initiated by the learner.

The MOOC designs fit with a dichotomous view of adult learning, in which learning is viewed as either *cognitive* (individualistic) or *social* (participatory). A good description of this dichotomy is given in Sfard (1998) on the role of self in learning through acquisition and in learning through participation. Some educationalists believe cMOOCs represent a pedagogical approach ideally suited to the network age. However little known about how the learning experience afforded by a MOOC is suited to the diverse range of learners who participate in each course (Milligan, Littlejohn & Margaryan, 2013).

At the time of writing this paper (May 2013), hundreds of MOOCs have been offered by universities around the world (see Table 1 and Table 2). The majority of MOOCs are xMOOCs, largely for two reasons. Firstly, the design follows a conventional online learning structure, compared with the more radical cMOOC design. Secondly, the xMOOC design is easier for learners who have undeveloped digital and learner literacies.

Table 1: Selected list of selected xMOOC providers

MOOC Provider	URL
Coursera	https://www.coursera.org
Edx	https://www.edx.org
Udacity	https://www.udacity.com
Futurelearn	http://futurelearn.com
Openstudy	http://www.openstudy.org
Codecademy	http://www.codecademy.com
Openlearning	https://www.openlearning.com
NPTEL	http://nptelonlinecourses.iitm.ac.in
Khan Academy	https://www.khanacademy.org
Udemy	https://www.udemy.com
ALISON	http://alison.com

Table 2: Selected list of cMOOCs

cMOOC	URL
Inclusive Technologies for Reading	http://www.load2learn.org.uk/training/onlinecourse/
#etmooc – Educational Technology & Media	http://www.etmooc.org
Open Learning Design Studio MOOC	http://www.olds.ac.uk/home
A Gentle Introduction to Python	http://www.mechanicalmooc.org
Differentiating Instruction through Technology	http://www.diffimooc.com
MOOC Maker Course (in German)	http://www.howtomooc.org
Contemporary Latin American Literature (in Spanish)	http://www.eberkeley.org/mooc/
DS106: Digital Storytelling	http://www.ds106.us
Open Course in Technology Enhanced Learning (OCTEL)	http://www.octel.alt.ac.uk
Spanish MOOC	http://www.spanishmooc.com
Think Tank – Ideal City of the 21st Century (Leuphana Digital School, Leuphana University)	http://www.digital.leuphana.de
Introduction to Complexity (Funded by Sante Fe Institute)	http://www.communityexplorer.org
Power Searching	http://www.powersearchingwithgoogle.com/course/aps
Advanced Power Searching	http://www.powersearchingwithgoogle.com/course/aps
MoocMooc	http://www.moocmooc.com

Hundreds more MOOCs – most of them xMOOC type - are being planned by an even wider group of universities, companies, professional bodies and other types of organisations.

What are learners' experiences in a MOOC?

There are few empirical studies of how people learn in MOOCs. Key findings in the literature are:

First, to learn effectively within a MOOC, students have to have a good level of digital literacies (Fini, 2009) and learning literacies (Kop, 2011; Kop & Fournier, 2011; Littlejohn, Beetham & McGill, 2012).

Second, to benefit from cMOOCs, learners have to be able self-regulate their learning in MOOCs, by setting and attaining learning goals (Littlejohn, Milligan & Margaryan, 2011).

Third, there are inherent tensions in MOOC design. For example, the tension between student autonomy and the diversity of thousands of students in a course means that it is difficult to design a course that satisfies all participants. The tension between the openness of a digital, networked environment and the tight connectedness of course participants means that MOOCs can suffer from 'homophily', where people with similar view tend to stick together, rather

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than seek diverse opinions and interpretations (Mackness, Mak & Williams, 2011; Falconer, Littlejohn, McGill & Beetham,2013).

Although little is known about learning in MOOCs, a number of studies have explored adult learning in open, unstructured, networked environments. Learning in these sorts of environments involves making sense of the available knowledge and reinterpreting it in a way that fits with the learner's knowledge framework – described by Saljo (1979) as learning by "seeking meaning". Meaning making involves making connections – connecting, disconnecting and reconnecting knowledge fragments through knowledge creation. While learning through social knowledge creation, individuals connect with relevant knowledge resources and with other people who share a similar learning goal (Littlejohn, Margaryan & Milligan, 2011). 'Clusters' of learners within a network travel a learning pathway together, navigating and making sense of the available knowledge resources. People learn together through connecting and making sense of knowledge fragments within a large pool of collective knowledge (Siemens, 2005). As they learn people connect across the networks to bring together the knowledge and expertise they need (Downes, 2008).

Learning is characterised by processes of discovery, sense-making, synthesis and sharing of (previously fragmented) knowledge resources. Since each individual learner encounters a learning situation with a unique combination of knowledge, values and culture, they create unique, multiple learning pathways.

How do learners learn in open, unstructured, networked environments?

Two discrete metaphors of learning are *learning through acquisition* and *learning through participation* (Sfard, 1998):

Learning through acquisition, characteristic of formal education where learning goals are set by an instructor. Here learning tends to be pre-planned and takes place in controlled settings.

Learning through participation, is where groups of people learn through collaborative activities. These activities could be authentic, for example learning through carrying out a regular work task, or mimetic, learning through 'just being there', observing and imitating someone with greater expertise.

Another third, relevant metaphor is *learning through knowledge creation* in which people learn through the creation of knowledge artefacts (Paavola and Hakkarainen, 2005). Typical examples of knowledge artefacts are (from medicine) patient cases which can be viewed as mediating objects that provide a focal point for knowledge creation (Cetina, 2008). Knowledge creation may involve boundary crossing – across disciplinary or sectoral boundaries – bringing together multiple perspectives in ways that allow the learner to learn.

When individual learners learn through connecting with the collective knowledge, it generates a new paradigm for learning in which the individual and 'the collective' are indivisible. When people learn through social knowledge, they collaboratively develop new knowledge artefacts and products. People learn by both drawing on and, *at the same time*, contributing to collective knowledge. So, 'connecting' is only one of a series of actions learners have to take to learn in open, unstructured networks. An important question is what do learners do as they learn in open, unstructured, learning environments?

What do learners do as they learn in open environments?

One example of an open, unstructured, learning environment is the Global Knowledge Networks used by multinational companies. These networks are used to support professionals' learning and to build and share new knowledge people need to solve work problems. A study by Littlejohn, Milligan and Margaryan (2011) surfaced the learning behaviours of knowledge workers who were members of global, online knowledge sharing

networks. Each network comprised a few hundred to a few thousand professionals at various stages of their career. Members used the online networks to exchange knowledge and discuss problems and solutions.

Data were collected through a mixed methods approach: a web-based questionnaire survey followed by semi-structured interviews. The quantitative survey was adapted from an existing survey instrument. The survey was carried out using an online survey tool (www.surveymonkey.com) and is available at http://dl.dropbox.com/u/6017514/survey.pdf. The survey was posted to the knowledge networks. These networks are large (with a combined membership of more than 30.000 members), but only a fraction of users are active and the link to the survey is likely to have been seen by only the most active members. The survey was open for four weeks between September and November 2008. The 462 survey respondents were located around the world, representing a broad range of job profiles, and all experience levels suggesting that it is broadly representative. Of these respondents, 29 took part in semi-structured, telephone interviews lasting one hour to elicit information about how they learn in the knowledge networks. The interview script is available online[1]. The survey data was tabulated and analysed using SPSS 16.0. Interview data was transcribed and coded using NVivo 8. For the qualitative analysis, an initial set of conceptual codes were defined and refined through four iterations.

The analysis identified four key learning behaviours representing different ways in which learners interact with and make sense of knowledge as they learn:

Learners **connect** with relevant knowledge resources, with other people, and with the 'cumulative actions' of others – for example recommendations, tag clouds or connections. Connections can be loose and serendipitous, or can be targeted, for example searching for and connecting with an expert or peer with specific expertise. Connections may be reciprocal or unidirectional. Through these connections learners continually refine their view of the collective knowledge.

Another essential element of learning and sense-making processes is **consuming** – or using – knowledge. Each individual has to use knowledge to be able to reinterpret it, taking into account their current knowledge. Learners may discover new knowledge through their personal network, or more actively, through online searching.

A by-product of using knowledge is the **creation** of new knowledge. These knowledge artefacts could be explicitly contributed resources, such as articles, podcasts, and so on, work in progress (for example blogposts, tweets, etc) or implicitly contributed resources, such as 'actions' and 'choices' that help other people (choices, tags, and so on). These new knowledge structures created represent a dynamic and individually-focused view of the knowledge and understanding learners have on a given topic, and how different topics inter-relate. Structuring knowledge adds a layer of value that other learners can benefit from. This sense-making process is continual, and ensures that the knowledge space evolves with the ideas of the individual, their network and the whole collective.

These new knowledge resources are sometimes (though not always) **contributed** back to the collective. Knowledge can be contributed formally (as reports, publications, and other standalone artefacts) or informally (reflections, ideas, ratings and other context-dependent content).

These four learning behaviours - *consume, connect, create, and contribute:* termed *the 4C learning behaviours* - are complex and inter-related (see Fig.1). However, together, they represent the ways in which an individual learner interacts with other people within a network to

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[1] http://dl.dropbox.com/u/6017514/interviewscript.pdf

achieve their learning goals. Other studies have identified similar behaviours. Kop (2011) describes a set of behaviours that enhance learning in connectivist networks: *aggregation, relation, creation* and *sharing*, while Davenport (2005) outlines a typology of knowledge activities, including *creating, packaging, distributing* and *applying* knowledge. In carrying out these actions, learners accrue new knowledge, integrating it with their current understanding, such that their expertise changes dynamically to match their current needs.

Fig 1: The 4C model of learning behaviours

To learn effectively in unstructured environments, learners have to be able to employ the sorts of open learning practices described, creating new knowledge for future learners to benefit from. A vision for future learning is that learners will expect to contribute to the learning of others as well as learning themselves, viewing themselves as the experts in their own situation. In some cases they may elect to take a short formal course, but this is always for a specific reason rather than as a cultural norm. The vision requires that learners can self-regulate their own learning.

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How do learners self-regulate their learning?

To learn effectively in unstructured environments, learners should be able to self-regulate their learning through goal-setting, self-monitoring and self-reflection (Zimmermann & Kitsantas, 2005). Sitzmann & Ely (2011) conducted a meta-analysis of a number of different models of self-regulation that had been applied to learning in the workplace to identify commonalities and differences, emphasising its dynamic nature and importance in informal work contexts. Their analysis identified a core set of constructs common to all theories of self-regulation, concluding that differences between models largely reflected different theoretical traditions. The Social Cognitive model of Self-regulation (Zimmermann & Kitsantas, 2005), with its origins in the educational psychology domain, is typical of many models of self-regulation in separating the Self-Regulated Learning (SRL) process into: **forethought**, **performance** and **self-reflection**, occurring in a cycle. During the **forethought** phase, the individual recognises gaps in their knowledge, formulates goals and plans their learning. In the **performance** phase, learners make decisions about effort and enact learning strategies, all the while monitoring their performance. In the **self-reflection** phase, the learner self-evaluates their learning based on internal or external criteria, driving further goal-setting and planning. In knowledge-intensive workplaces, SRL is a highly social process, structured by and deeply integrated with work tasks (Margaryan, Littlejohn & Milligan, in press). However, it remains a challenge to understand how workers can successfully enact self-regulated learning (SRL) strategies and behaviours in pursuit of learning goals in the workplace, and how these behaviours can be supported by employers.

Table 3 maps the 4c learning behaviours to different phases of the self-regulated learning cycle, highlighting specific behaviours typical of each phase (Milligan, Littlejohn & Margaryan, *in press*).

Table 3: Mapping the 4c learning behaviours to the Self-Regulated Learning cycle

	Consume	Connect	Create	Contribute
Forethought	Explore learning requirements via a search engine or other trusted information source(s)	Connect to personal learning network to seek advice, or identify others with similar learning goals	Formulate goals or complete personal development planning tool	Make goals or development plan or learning strategies open to the public
Performance	Discover new knowledge to help achieve learning goals	Engage with others to achieve learning goals, through collecting and connecting knowledge and developing new knowledge structures	Create new knowledge or augment existing knowledge	Make new knowledge and knowledge structures public, through formal and informal mechanisms
Self-reflection	Seek evidence to validate of strategy	Find others with similar experiences to establish/confirm causality	Write personal, private reflection notes	Public self-reflection through blogging or similar mechanisms

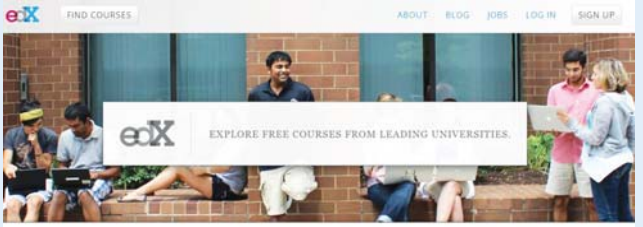
In other words, the four learning behaviours people carry out while learning and using collective knowledge are connecting, consuming, connecting and contributing knowledge. These four behaviours represent a sense-making process that forms the basic step in learning in open, unstructured environments. They are a set of intertwined activities rather than discrete linear steps. This sense-making process has been termed 'charting' (Littlejohn, Milligan and Margaryan, 2011).

Charting is a sense-making process comprising generic actions of consuming, connecting, creating and contributing knowledge that learners carry out during collective learning. Charting connects learners to others with similar goals, creating networks of people who may support each other during learning. It can help individual learners in defining, sequencing and reflecting upon their personal learning goals.

Charting can be implemented as a set of web-based tools to support each learner in dynamically mapping and managing their own view of the collective knowledge. The learner can configure the components of the collective to suit his/her personal needs at any given time. The individual connects with relevant fragments of knowledge to support his or her learning and feeds the outcomes of his or her learning back to the collective, for others to learn from, consume and build on.

Although charting is individually-driven, it is not an individualistic sense-making process, since the learner draws from the collective and contributes back, through deliberate actions and through machine analytics that aggregate individual behaviours into the collective.

The range of behaviours observed in this study can be summarised by: *in the workplace, individuals consume, connect, create and contribute to the collective knowledge.* These four knowledge behaviours - connecting, consuming, creating and contributing to the collective knowledge - are intertwined activities rather than discrete linear steps.



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How do people learn in MOOCs?

To examine Self-Regulated Learning behaviours in MOOCs, we conducted a study of participants in a cMOOC (Change11, 2011) in Jan 12-Apr 2012. The study used a mixed method: a Self-Regulated Learning Questionnaire was used to measure learners SRL scores. This was followed by a series of one-hour, semi-structured interviews (sample: survey: n=29 interviews: n=29)

Our hypothesis was that people who exhibit a high degree of Self-Regulation in their learning will use qualitatively different strategies to plan, monitor and reflect on their learning than individuals who exhibit a low degree of Self-Regulation in their learning[2]. By gaining a deeper insight into the patterns of engagement in MOOC courses, this study provided insight into how future MOOCs can be designed to better support the learning needs and expectations of a wider range of learners that co-exist within MOOCs.

The study examined the *patterns of engagement within the Change11 MOOC course* and *the factors that mediated engagement.* Three distinct levels of engagement exhibited by the participants were identified: *active* participants, *lurkers* and *passive* participants.

Active Participants adapted well to the connectivist pedagogy of the cMOOC, interacting with others in the course through internal networks through micoblogging or blogging. They seemed to appreciate that course participation required more than broadcasting ideas and used a range of connection strategies, such as contacting others on the course or commenting on other peoples' blogs.

Lurkers actively followed the course but did not engage with other learners. Lurking was a choice these people actively made.

Passive participants tended to be dissatisfied with the course. The 'connectivist' approach of the course was not appropriate or useful for them since they did not see the inherent value of learning through the network. These participants would have preferred a formal and more structured course. Factors affecting their engagement with the MOOC included confidence and prior experience with MOOCs.

These findings are part of a larger study examining self-regulation of learning in Massive Open Online Courses (Milligan, Littlejohn & Margaryan, 2013). While the whole study contributes empirical evidence about learning in Massive Open Online Courses, these findings are relevant for cMOOCs (connectivist). Empirical evidence has not been gathered for xMOOCs, which are likely to have different cross-section of participants.

Implications for Open and Distance Learning institutions

Massive Open Online Courses are still a relatively new form of learning. The trend towards open learning opportunities is likely to continue, though the future format of these opportunities is still unclear. MOOCs may continue for some years in the future, or may morph into another form of open learning. There are significant implications for Open and Distance Learning Institutions.

First, there is no agreement as to whether 'open' means 'free'. While most MOOCs are freely available, not all are. Business models that enable Open and Distance Learning Institutions to profit from MOOCs are still in their infancy. Some institutions charge for the course or have an optional fee if students want to gain accreditation. Others use advertising or a 'freemium' model. However, at the time of writing, most institutions around the world running MOOCs run the course as a 'loss leader' – to attract students who may register and pay for future courses. One example of this type of activity is the British Open University's 'Open Learn' initiative that makes learning resources feely available – advertising through BBC television series on relevant topics.

[2] The term self-regulation here refers to *"self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals"*

The Open University claims to have statistics that evidence an increase in student numbers through the Open Learn activity (Openlearn, 2013). Therefore *ODL institutions have to devise and implement new business models if the goal is to gain an income stream from a MOOC.*

This first point is related to a second issue relevant to ODL institutions – the motivation for running a MOOC. The motives for universities and individuals around making MOOCs openly available are not always clear. While most institutions state altruistic reasons for opening up courses, there are underlying motivations around branding and marketization. A UK-wide study of motivations of individuals and of institutions (Falconer, Littlejohn, McGill & Beetham, 2013) revealed significant tensions around the relationships of some academics who gain a reputation for leading MOOCs with their institutions. As the individual's reputation grows, and they have greater control over their own work, they may have different form of commitment to and relationship with their institution. *The relationships between ODL institutions and employees may change as openness becomes more mainstream.*

With the sort of mass participation inherent in MOOCs it can be difficult for institutions to retaining quality learning experiences for students. (see for example http://oersynthesis.jiscinvolve.org/wp/2013/03/11/oep-and-bounded-communities/). Institutional quality mechanisms are often at odds with the idea of 'openness'. For example, one quality measure on many conventional online courses is the 'completion rate'. MOOCs tend to have low completion rates, depending on a number of factors, such as students' reasons for registering for a course, whether the course is free or requires a fee and whether the MOOC is an 'add on' or embedded within mainstream teaching and learning. MOOCs are rarely embedded into other forms of learning and are usually offered as an 'add-on', which may limit their overall effectiveness. *ODL institutions should embed MOOCs in mainstream learning.* Also *ODL institutions have to rethink their quality processes to allow for the openness inherent in MOOCs.*

Finally, satisfactory participation in MOOCs usually requires participants to be able to actively self-regulate their learning. *ODL institutions should design MOOCs to take into consideration the wide range of participants on each course.*

Finding Out More

You can find more information about MOOCs at the website (http://mooc.ca/) managed by Stephen Downes. Educause Library also has a special page on MOOC that can be found at http://www.educause.edu/library/massive-open-online-course-mooc

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