Universities UK

Massive open online courses

Higher education's digital moment?

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FOREWORD

The rapid development of 'massive open online courses' is currently generating considerable excitement in the world of higher education. With the potential for a great democratic shift, MOOCs offer a chance for millions of people, whoever they are, wherever they are, to follow courses led by distinguished scholars, and at the same time connect with a community of like-minded fellow learners around the globe. And for the moment at least, access to these courses is entirely free. In turn, academics and institutions are able to communicate with people on a scale that was barely imaginable just a few years ago.

To many, this looks like a revolutionary moment, heralding a new era for higher education. As with most revolutions, at this early stage it is very hard to predict what the outcomes might be, either for the way people access higher education, or for the way it is provided. Any discussion of MOOCs immediately throws up a series of challenging questions. Can the free provision of content continue to be rolled out, to the massive extent that is now possible, in a way that is financially sustainable, or will it need to depend on philanthropic or other kinds of public investment? Can an entirely open online course, with hundreds of thousands of students enrolled, provide students with the learning and qualifications that they need to develop personally and professionally? Can these types of courses be accredited in a way that gives employers the confidence that they are recruiting individuals with the authenticated skills and qualities needed for the success of their organisations? Who will want to pay to go to a traditional university, and what sort of experience will they expect, if they can access the lectures of world-leading scholars for free?

These developments are indicative of a wider set of developments that are happening beyond the world of education. They are part of a sea change in attitude towards online spaces across our lives, with the widespread application of online technology that already takes place in diverse arenas, from banking and retail, media and publishing, to online friendships and social networking.

It is too early to say if MOOCs represent a fundamental game-changer for traditional providers of higher education, or to predict how individual universities might have to adapt, whether they are engaged in MOOCs or not. It is possible, however, that such a significant and potentially disruptive development could have radical and far-reaching consequences for many institutions. A pattern is emerging, throughout all sectors, of a major shift towards online models of delivery tending to disrupt traditional incumbents, and traditional ways of doing business.

With such matters in mind, this report from UUK aims to provide a helpful and timely summary of recent developments, and a discussion of the issues behind the provision of MOOCs. The global growth of online learning, to the extent that it becomes a major feature of the higher education environment, may well represent a threat to some institutions. At the same time, UK universities have proved themselves to be flexible, resilient and entrepreneurial, and many will be looking online for new opportunities to develop their provision and their profile.

Professor Paul O'Prey
Vice-Chancellor, University of Roehampton and
Chair, UUK Longer Term Strategy Network

EXECUTIVE SUMMARY

Massive open online courses are free, open access and scalable online higher education courses. MOOCs use a variety of online resources (such as videos and message boards) and seek to capitalise on high volume student classes by encouraging peer learning networks in place of more conventional synchronous learning and academic instruction. MOOCs may be developed independently by academics or they may be developed as part of contractual agreements between higher education institutions and third party online platforms. They enable students to access high quality academic content, and academics to engage with a much wider audience.

MOOCs have expanded dramatically in recent years, growing from a small selection of specialist courses to millions of registered users on major online platforms offering hundreds of courses. MOOCs are typically suited to more advanced learners who require less academic support to navigate their way through courses and materials. However, practice is developing rapidly to improve the quality and experience for students at different levels. Courses are typically stand-alone and students may receive a certificate of completion and can have their examination validated for a fee. Other paid-for services are also being developed by MOOC platforms, such as career services or tuition support services.

Different methods of recognising MOOCs for academic credit are being explored to help capitalise on their low cost and flexible models of learning. These include recognition of prior learning for entry onto courses, and potentially contributing toward a subsequent higher education award. In addition, reciprocal and licensing arrangements are being developed that integrate MOOCs into the curricula and awards of third party institutions. These educational services are likely to form a significant part of the strategies of the major online platforms to develop sustainable business models after their initial capitalisation.

MOOCs represent a global, low cost, high volume model of flexible delivery that presents a number of opportunities for higher education. MOOCs have the potential to support institutional missions by enabling academics to engage with new and potential students, and to encourage recruitment onto courses. They can drive the international reach of institutions, including recruitment and supporting overseas activity such as transnational education. MOOCs can help to meet the demand for career-long education through low cost, flexible models of provision. Furthermore, by diversifying learning pathways MOOCs may help to expand the opportunities for institutions to offer rounded developmental education that MOOCs in themselves don't provide.

MOOCs may also help to restructure and lower the costs of higher education in ways that may be attractive to learners looking for lower-cost provision and which present opportunities for new and existing providers. The development of free-at-the-point-of-use models of delivery may require changes in the strategy of institutions, such as the development of shared educational services through reciprocal and licensing arrangements. At the very least these developments are likely to challenge institutions to explore how practices, such as pedagogies, processes and the skills and competencies of their people, may need to be developed in order to make the most of the new operating environment.

This model of free, accessible and flexible delivery through third party platforms using broadcast and distributed peer learning represents a new relationship between academics, students, institutions and education technology firms. A decisive shift toward this model would represent a significant change for higher education. Experience from other sectors suggests that there are also opportunities to develop effective approaches that blend online and free approaches with more traditional face-to-face and paid-for models. However, all institutions will need to evaluate their long-term strategies in light of these developments and many are already developing their responses to this rapidly changing landscape.

Universities UK recommends that institutions consider the following questions:

What are the aims of engaging with massive open online courses?

- **Mission.** What role can open online courses play in communicating knowledge and expertise, and raising the profile of your institution and its departments around the world?
- **Recruitment.** What role can MOOCs play in diversifying recruitment pathways, particularly among students from non-traditional, adult and professional backgrounds and from overseas?
- **Innovation.** What role can open online models of delivery play in improving the quality and value of online and traditional courses for students, employers and society?

What organisational changes do new online models of education require?

- **Sustainability.** What are the costs of developing and running open online courses and what are the wider implications of a shift toward free course content for the sustainability of existing business and pedagogical models?
- **Pedagogy.** How can an institution add value to the educational experience of students beyond free and low cost models to develop different skills, and to facilitate access to a variety of social and professional networks?
- **Credit.** What institutional and sector arrangements should be made for recognising certain MOOCs for entry onto paid-for courses and toward a final higher education award?
- **Capacity.** What is the appropriate balance between rapid, flexible innovation and wider development of professional and institutional capacity to implement new online models of delivery?

This report was developed with input from the Universities UK Longer Term Strategy Network.

INTRODUCTION

There is a long-standing policy interest in the role that online learning can play in extending affordable access to higher education in order to equip society for the challenges of rapidly developing knowledge economies and globalisation. This report explores recent trends in open online distance learning, with particular reference to the development of massive open online courses (MOOCs). It assesses the main features of these trends, and the future challenges associated with these fast moving developments. Finally, it looks at some of the considerations that institutions and the sector as a whole may wish to take into account in order to respond effectively to the potential benefits of open online models of delivery.

Increased access to the web and new digital technologies have reshaped many areas of life, from broadcasting and publishing to social relations, and are encouraging new patterns of communication and networking. Broadband connectivity in the UK has increased from 25% in 2005 to 76% in 2011 and government has set a target of universal access to two megabits per second broadband and 90% access to superfast broadband.[1] The introduction of 3G and 4G networks has also facilitated increasingly mobile connections through 'always-on' devices such as tablets and smartphones. Furthermore, mobile connectivity is also increasing in emerging economies, including China where Ofcom research suggests mobile connections are becoming the main way of connecting to the internet[2].

Ofcom: *Communications Market Report 2012*

Increasing use of always-on and mobile devices to access the internet:

66% of those aged 16 to 24 and 60% of those aged 25 to 34 have a smartphone. Over four in ten smartphone users say their phone is more important for accessing the internet than any other device. Smartphones are increasingly being used in different ways in people's lives – to help them shop (57%), check-in on a social network (30%), tweet (23%) and watch TV and film content (22%).

Ofcom research indicates that tablet ownership is increasing rapidly, from 2% of UK households in Q1 2011 to 11% in Q1 2012, and that one in six (17%) households are intending to buy a tablet in the next year. Two-thirds (65%) own a tablet that connects to the internet via a WiFi connection only, while 33% own a WiFi- and 3G-enabled version.

Growth in text-based communication and video content:

For younger people, text-based services, including social networking sites, dominate communication with friends and family. Around nine in ten 16 to 24 year olds send texts and three-quarters (73%) use social networks. Face-to-face communication is less popular (63%) as are mobile phone calls (67%) and landline calls (15%).

Time on video-sharing sites has increased, as users spend longer on YouTube. In January 2012, 3.7 billion videos were viewed on YouTube in the UK. While its unique audience remained stable at 19.8 million unique visitors per month on average, the time per person on the site increased by 42% between March 2011 and March 2012, to 1.5 hours per month. Users aged between 2 and 17, and 18 and 24, constituted a larger proportion of YouTube's unique audience than other leading websites.

1. For details of online connections see Ofcom (2012) *Communications Market Report*, available at: http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/CMR_UK_2012.pdf For details of government targets see DCMS press release 'Government aims for superfast broadband to reach 90 per cent of homes and businesses', 12 May 2011, available at: www.culture.gov.uk/news/media_releases/8099.aspx

2. Based on 2012 research by Ofcom that suggested mobile connections of 70 per 100 households in comparison to the 2011 industry data that showed fixed connection rates of 39 per 100. However, 2012 research is believed to have engaged a disproportionate number of 'early adopters'.

Higher education has been at the forefront of the development and application of many of these technologies. For example, academic institutions and research collaborations in the US and Europe have helped to drive the development of the internet and inspired the development of the principles underpinning the world wide web. Academic journals have been routinely digitised since the end of the 20th century and higher education institutions run networks that deal with tens of thousands of unique users often working remotely and using their own devices. Almost all institutions run online learning management systems that allow students to access their course materials, such as reading lists and videos of lectures, in their own time and use a variety of other classroom technologies.

However, online delivery of higher education remains a relatively small part of the UK sector. The Higher Education Funding Council for England's Online Learning Task Force highlighted ongoing challenges for the development of online provision in the UK (see *Collaborate to compete* text box). According to a 2010 study conducted for the task force, UK online distance courses are typically postgraduate professional development or vocational courses delivered in partnership between a higher education institution and a specialist provider and often enrol students from the UK and internationally[3]. In the US, growth in online education has been stronger and there are now over six million students taking at least one online course, making up nearly a third of all enrolments.[4] The growth has largely been driven by the recruitment of non-traditional groups by for-profit institutions.

Collaborate to compete: Seizing the opportunity of online learning for UK higher education

Report to HEFCE by the Online Learning Task Force, January 2011

Recommendations

- Technology needs to enhance student choice and meet or exceed learners' expectations.
- Investment is needed to facilitate the development and building of consortia to achieve scale and brand in online learning.
- More and better market intelligence about international demand and competition is required.
- Institutions need to take a strategic approach to realign structures and processes in order to embed online learning.
- Training and development should be realigned to enable the academic community to play a leading role in online learning.
- Investment is needed for the development and exploitation of open educational resources to enhance efficiency and quality.

MOOCs are situated in the long history of university extension, open education and widening participation initiatives that have sought to extend access to higher education. MOOCs are also situated in the open education resources (OER) agenda that encourages academics and institutions to make educational resources available for free, for learners and educators to reuse, repurpose and remix.[5] OER can range from single documents and lectures to, increasingly, multi-part courseware. Initiatives include the Open University's OpenLearn, the Open Courseware Consortium led by the Massachusetts Institute of Technology (MIT), and projects supported by the HEFCE-funded JISC and Higher Education Academy OER programme between 2009 and 2012.[6] Many institutions also make videos and podcasts of lectures and talks available online for free through their own websites or platforms such as iTunes U.

3. For further information on the profile of online learning in the UK see White et al (2010) *Study of UK Online Learning, Final report* Bristol: HEFCE available at: www.jisc.ac.uk/media/documents/projects/UKOnlineLearningStudy-FinalReport-Mar10-FINAL-FORPUB.pdf

4. Sloan Consortium (2011) *Going the Distance: Online Education in the United States, 2011*: sloanconsortium.org/publications/survey/going_distance_2011

5. For further details of OER practice in the UK see the JISC-funded OER impact study 2010-11: *The value of reuse in higher education*: www.tall.ox.ac.uk/research/past/OERImpact.php

6. For further details of the JISC-HEA OER programme and the projects and outputs that were funded by it see: www.jisc.ac.uk/whatwedo/programmes/elearning/oer

1: CHARACTERISTICS OF CURRENT DEVELOPMENTS

Massive open online courses are free, open access and scalable online higher education courses. The term was coined in 2008 to describe a particular model of open online courses developed by Canadian academics Stephen Downes and George Siemens based around a distributed peer learning model. The MOOC field has subsequently evolved rapidly, particularly since 2011, with an increasing volume and diversity of MOOC-style initiatives being run by academics, institutions and companies. As a result the concept of the MOOC has extended to denote almost all courses offered for free, online and at scale.

MOOCs are usually distinguishable from more conventional online distance learning by the absence or highly limited nature of personalised academic support and guidance for students.

Two broad categories of MOOCs have been defined, based on different pedagogical emphases and organisational models:

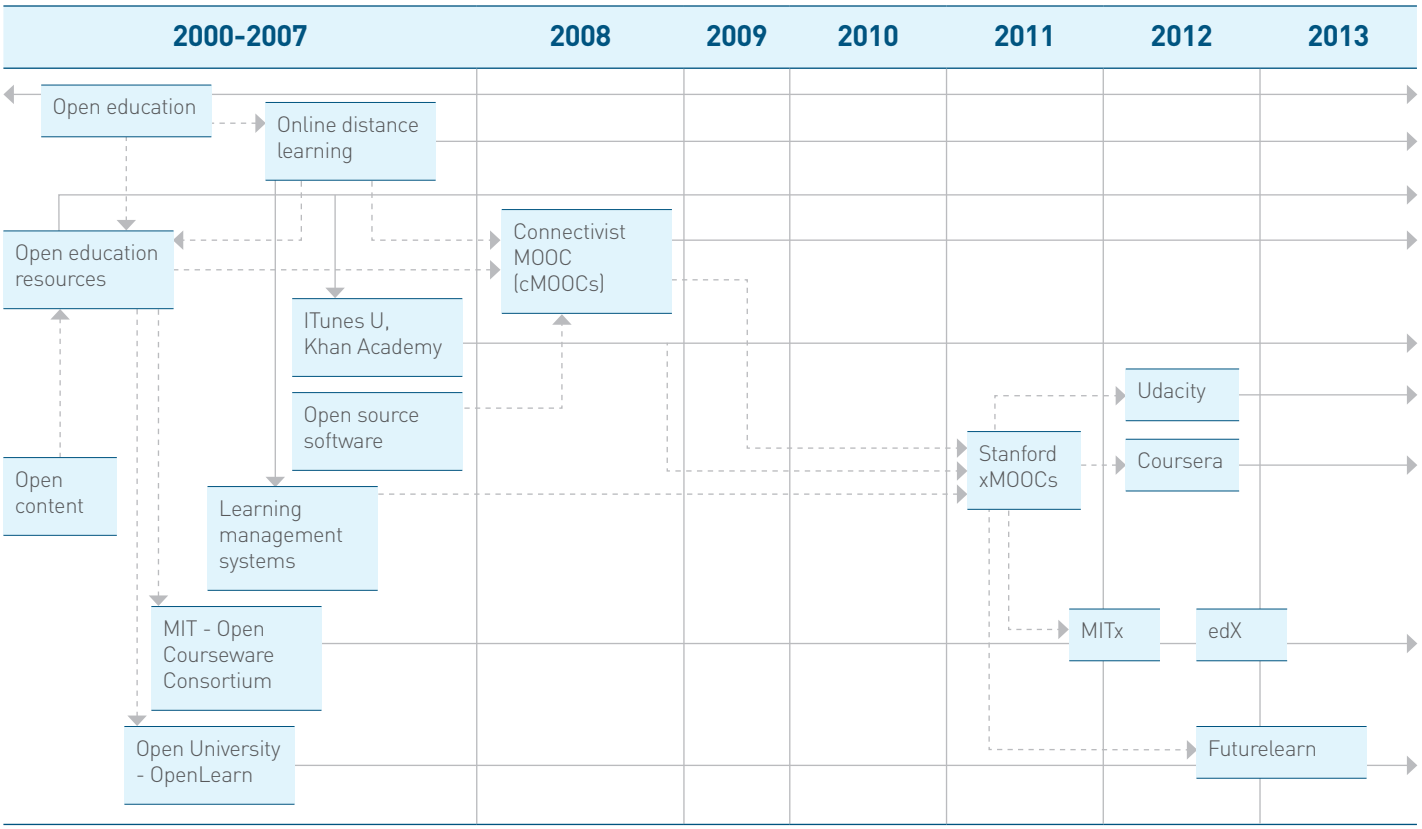
- **cMOOC**. These are courses based more closely on the original 'connectivist' distributed peer learning model. Courses are typically developed and led by academics through open source web platforms. Examples include various courses exploring developing online education practice, such as the original MOOC, Connectivism and Connective Knowledge.
- **xMOOC**. These courses are typically structured around more conventional lecture formats and are increasingly delivered through proprietary learning management platforms with contractual relationships with institutions or individual academics. 'xMOOC' typically describes courses offered through the Coursera, edX and Udacity platforms.

As the field has developed the xMOOC platforms have come to dominate much of the debate around both MOOCs and, increasingly, online distance learning more generally. This high profile is linked to their financial backing, the range of courses that they offer, the volume of enrolments they have attracted and the profile of the institutions that have partnered with them. However, both types of MOOCs have demonstrated significant potential in terms of their contributions to the delivery of higher education by expanding the opportunities for students and institutions to engage with each other in new ways. Furthermore, the pedagogical distinctions between the two categories of MOOCs and other types of online, distance and conventional learning are increasingly blurred as academics, institutions and platforms experiment with new ways of delivering open online courses at scale.

This section of the report assesses some of the key features of recent developments including the growth and profile of the MOOC sector, some of the pedagogical features of MOOCs, and evolving validation and credit recognition arrangements.

Massive growth

Figure 1: Timeline of MOOC developments



Adapted from Yuan and Powell (2013) *MOOCs and Open Education: Implications for Higher Education* (CETIS)

MOOCs have developed rapidly since 2008 due to their creative use of low cost online technologies to deliver higher education in new ways. Early MOOCs demonstrated the potential to bring dispersed networks of participants together into a distributed peer learning model through various open source and free web resources. In September 2011 three Stanford Engineering Everywhere courses demonstrated the potential of xMOOCs as a low cost, high volume model of online education. The courses attracted over 100,000 students each and included Introduction to AI by Peter Norvig and Sebastian Thrum and Machine Learning by Daphne Koller and Andrew Ng. The courses were based on a conventional format of recorded lectures, notes and assignments, which had previously been hosted on learning management systems for campus students.

Following the Stanford experiments, some institutions have started to develop more strategic approaches based on the xMOOC video lecture format. These initiatives have involved contractual arrangements between research-intensive institutions or academics and start-up technology firms to deliver courses through bespoke online course platforms. MIT launched its MITx platform in autumn 2011, which was subsequently incorporated into edX, a not-for-profit platform jointly owned by MIT and Harvard. Coursera was established by Daphne Koller and Andrew Ng in early 2012 as an independent for-profit technology start-up that offers courses provided by partner institutions. In addition there are independent for-profit initiatives, such as Udacity, set up by Sebastian Thrum, and Udemy, which work with individual academics or instructors from other fields such as business.

Table 1: Main MOOC platforms

Initiative	Coursera	edX
Overview	Platform founded by Stanford University computer science academics Professor Daphne Koller and Associate Professor Andrew Ng. Launched April 2012. Three million registered users by March 2013. The platform has partnerships with 69 universities including Stanford, Princeton, University of Pennsylvania, California Institute of Technology, University of Washington, University of Edinburgh and École Polytechnique Fédérale de Lausanne. Offers over 300 courses from range of subjects including computer science (69), biology and life sciences (25), humanities (36), economics and finance (23), business and management (15), food and nutrition (9), social sciences (5).	Platform founded by MIT and Harvard following MITx electronics and circuits course in January 2012. First courses as edX commenced in October 2012. Courses from the 12 members of the edX consortium: MIT, Harvard, Berkeley, University of Texas System, Wellesley College, Georgetown, Australian National University, École Polytechnique Fédérale de Lausanne, University of Toronto, RICE, TU Delft and McGill. 33 courses from range of subjects including social sciences and humanities, physical and natural sciences, computer science, law and health.
Strategy	Non-exclusive flexible agreement facilitating rapid and flexible development. Emphasis on high ranking and research intensive institutions with advisory panel linked to early partners and membership of Association of American Universities. Less centralised quality review process but reserves right to remove content of insufficient quality. Quickly extending its portfolio of courses and partners internationally and across subjects, including courses in French and Spanish.	Slower pace of course development with smaller number of universities. Emphasis on high ranking, highly selective research intensive institutions, with governing board led by MIT and Harvard. Partner institutions operate sub platforms with shared 'x' suffix. Centralised quality review process with flexibility for institutions to develop courses outside the core edX brand. Greater public emphasis on learning innovation and integrating with campus practice.
Business model	Private for-profit technology start-up funded by investment from venture capital firms Kleiner Perkins Caufield & Byers and New Enterprise Associates. Estimated $22 million investment. Equity investment from some university partners. No upfront costs to institutions but can pay Coursera to handle content on the platform. Depending on the lifetime of the course between 6% and 15% of revenue generated by Coursera to be shared with the university plus 20% of gross profits from all courses provided by the university. Partner institutions can use the course management system for internal courses for no charge.	Not-for-profit enterprise owned and funded by MIT and Harvard committing to $60 million investment. Contribution of technology platform by Berkeley. Additional philanthropic support, including funding from the Bill and Melinda Gates Foundation. Option of equity investment by partner institutions. Two types of arrangements: cash payment of $250,000 for edX to put courses onto platform with no less than 70% of gross revenue, and a self-service model with shared revenue of up to 50% after first $50,000 to edX. Online course platform to be made available open source.
Awards	Certificates of completion from Coursera. Proctored examinations provided in partnership with Pearson VUE. Also developing online validated assessment techniques.	Certificates of completion from the 'X University'. Proctored examinations provided in partnership with Pearson VUE assessment centres.

Futurelearn	Udacity
Platform set up by the Open University; has partnerships with 21 universities, including King's College London, Bristol, Southampton, Bath, Exeter, Cardiff, Glasgow and Queen's University Belfast. Other major partners include the British Library, British Council and British Museum, who will offer access to their unique digitised resources and courses. Futurelearn aims to deliver a learning experience that is engaging and entertaining and allows people to fit learning into and around their lives, whenever and wherever it suits them.	Set up by Sebastian Thrun, Research Professor of Computer Science, Stanford University and Google Vice President. 22 courses, all focused on computer science and associated technology subjects.
Will harness the skills and expertise of the Open University to allow students across the world to access high quality education online from some of the UK's foremost educational institutions. First courses expected in the latter half of 2013 with additional partners and courses from the UK and Europe expected to follow.	Works with individual academics and in collaboration with technology firms, including Google and Microsoft. Innovative course interface with blended interaction between video and exercises. Focuses on a smaller range of technology courses with no plans to expand to a wider range.
Third party for-profit enterprise owned and funded by the Open University. No upfront costs to institutions. Contribution in kind by partner institutions to develop courses.	For-profit enterprise supported by venture capital firms including Andreessen Horowitz, Charles River Ventures and Steve Blank. Estimated outside funding of $21 million.
Certificates of completion from Futurelearn. Proctored examinations expected but details to be announced.	Certificates of completion from Udacity. Proctored examinations provided in partnership with Pearson VUE assessment centres. Also developing online validated assessment techniques.

Venture capital funds with strong track records in backing successful technology start-ups have supported a number of the xMOOC initiatives, including Stanford Engineering Everywhere and the subsequent Coursera and Udacity start-ups. This is in the context of increasing venture capital fund investment in education technology firms, and acquisitions by major education publishers such as Pearson. Analysis conducted by Goldman Sachs suggests that the volume of investment in education technology has increased from $204 million in 2008 to nearly $900 million in 2012. In addition to MOOCs, significant investment has also gone into education software firms, including adaptive learning systems based on learning analytics and digital learning tools such as virtual learning environments and e-textbooks. Much of this investment is now focused on businesses that work in partnership with established higher education institutions rather than firms aiming to become full higher education providers themselves.

In the UK, Edinburgh and the University of London were the first institutions to sign up with Coursera, in the summer of 2012. At the end of 2012 the Open University announced its Futurelearn platform with a number of UK research-intensive institutional partners including the universities of Bristol, Warwick and Cardiff. Futurelearn differs from the US platforms in a number of ways. It is owned by the Open University, which brings specialist distance learning experience and expertise from a UK pedagogical perspective. Its chief executive has a background in digital media, in contrast to the academic technologists who both founded and are now CEOs of the major US xMOOC platforms. Its initial capitalisation is being supported entirely by the OU, with subsequent additional funding likely to come from other sources.

Figure 2: Venture capital investment in education technology

Venture capital firm	Investment	Date	Category
Greylock Partners	CreativeLIVE	2012	Online higher education
Investment Venture Partners	Udemy	2012	Online higher education
Jeff Bezos, Tony Hsieh	GA	2012	Post-secondary
Andreesson Horowitz	Udacity	2012	Online higher education
Sequoia Capital	Mind Snacks	2012	Smart games
Benchmark Capital	The Minerva Project	2012	Online higher education
NEA	EverFi	2012	Supplemental online education
KPCB NEA	Coursera	2012	Online higher education
ACCEL Partners	Knewton	2011	Adaptive learning
Andreesson Horowitz	Kno	2011	Digital textbooks
Benchmark Capital	Grockit	2011	Social learning / smart games
Bessemer Venture Partners	Flatworld Knowledge	2011	Digital publishing
Sequoia Capital	Inkling	2011	Digital textbooks

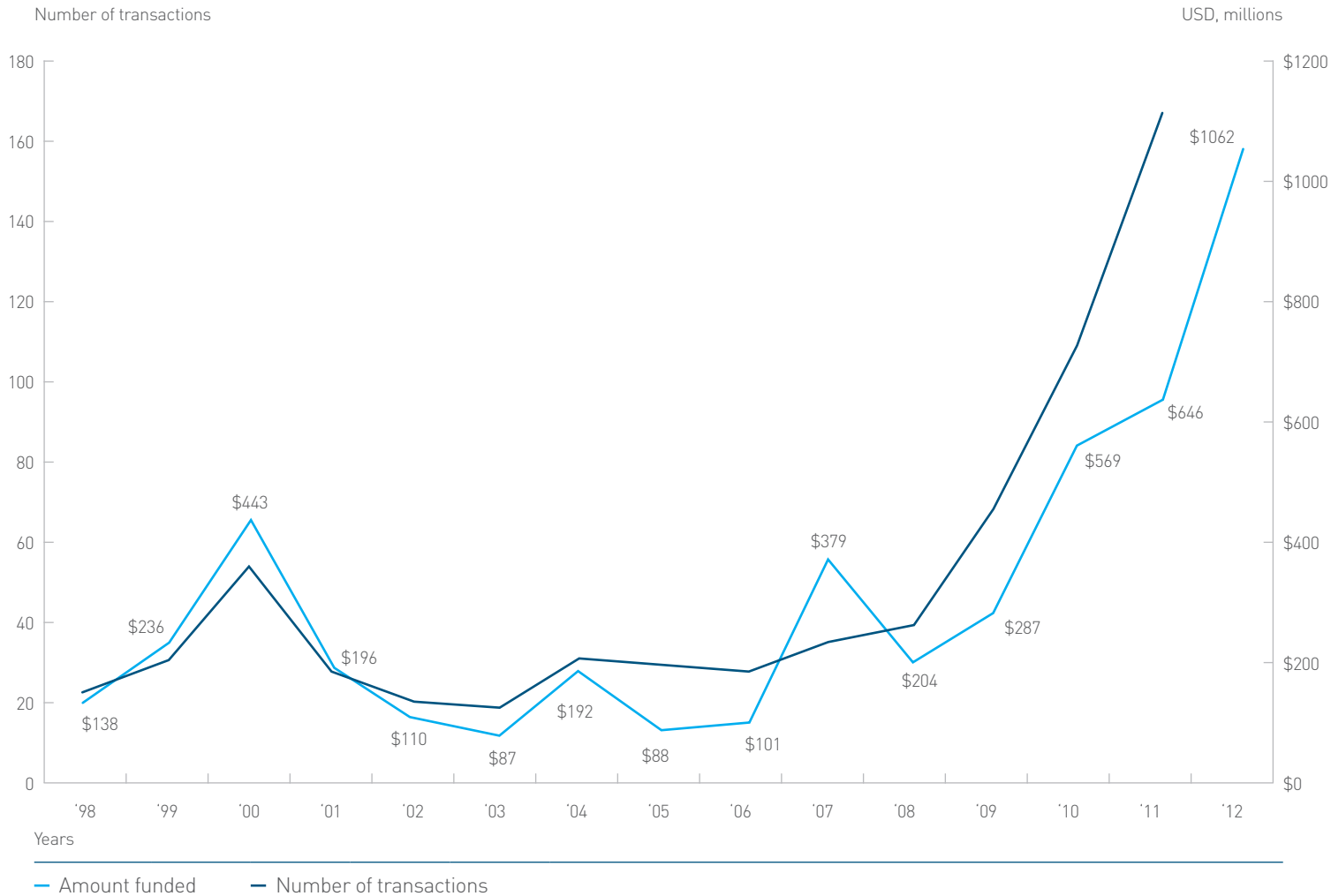
Analysis by Goldman Sachs. Sources: Bloomberg LP, Dow Jones VentureSource, S&P Capital IQ

Business models

The xMOOC providers are yet to set out a clear, sustainable business model. Their initial capitalisation is supporting a rapid expansion of partnerships and courses. The contracts between Coursera and edX and their partner institutions include proposed revenue sharing arrangements. Depending on the arrangement, the university may pay a fee for support to develop the online course or it can do it through a self-service model. Profit-sharing arrangements are structured on a course–by-course basis, dependent on the period that a course is maintained, and aggregated across the institution's portfolio. The xMOOC platforms differ from one another in terms of their processes for internal quality assurance but all retain rights around the quality of course design and materials. Partner institutions may also use the course platform for their own internal courses.

The xMOOC platforms are exploring a number of potential revenue streams but have not yet become financially sustainable. Furthermore, experience from other sectors suggests that free-at-the-point-of-use models are very hard to monetise. That said, given the overall size of enrolments it is anticipated that only a small proportion of students will be required to take up a paid-for service, such as a certificate or additional tuition support, to generate potentially significant revenues. Moreover, educational services such as licensing of courses would also generate significant revenues that may cover the cost of developing a course. However, it is not yet clear whether revenues generated by free courses would be sufficient to cover the upfront costs of course design and development for both the MOOC platform and the higher education institution.

Figure 2: Continued



Potential revenue options:

- **Front end services for students:** including proctored examination, certification, career guidance and direct tutoring
- **Back end services to third parties:** including analytics, design consultancy, recruitment services and advertising
- **Educational services:** including licensing of courses to higher education institutions and to training providers and firms for CPD and workplace development programmes

Supply

Most MOOCs to date have broadly been pitched as adult learning short courses. This has made courses accessible and of interest to the widest range of students, and reflects the profile of online provision offered by UK institutions. The early wave of provision was concentrated in subjects with staff and students attuned to developments in online technology and the skills to apply them to the delivery of courses with limited support – typically computer science and other technology subjects. However, the profile of courses on offer has subsequently expanded to cover the full range of subjects and Coursera's stated intention is to have as wide a range of courses as possible and equivalent to a multi-department university.

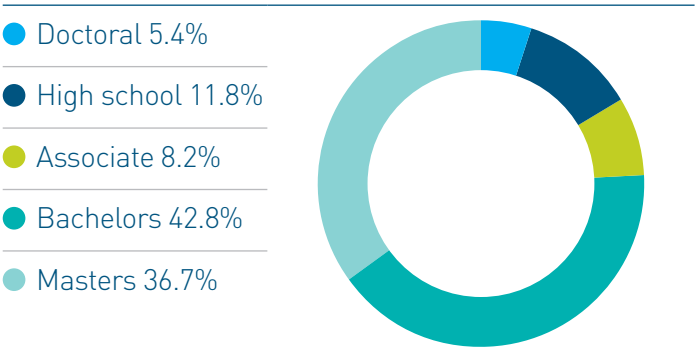
There is a growing emphasis on the role of MOOCs in supporting professional development that has driven improved validation, the development of 'badges', and recruitment services. There are also examples of courses being explicitly targeted at more vocational learners. For example, the University of Edinburgh's Equine Nutrition course, included in its first Coursera offerings, potentially connects with a vast cohort of students working with horses around the world, often in locations that do not have ready access to higher education institutions. Similarly the Information Security and Risk Management in Context course on Coursera is pitched explicitly at professionals who want to:

> Learn to defend and protect vital company information using the latest technology and defense strategies. Analyze internal and external threats to proactively prevent information attacks. Gain experience by solving real-world problems and leave the class equipped to establish and oversee information security.

At the same time there are also moves to segment MOOCs to target different levels of learners. The Udacity platform has introduced a tiered system of beginner, intermediate and advanced courses. This is also reflected in the work being developed by the edX platform to develop entry-level courses for college students and community colleges. These types of courses are designed to enable a wider range of students, including prospective and non-traditional students, to engage with educational content from leading institutions. The William and Flora Hewlett Foundation and the Bill and Melinda Gates Foundation have been influential supporters of this work, with the aim of improving the quality of education in the US and around the world by developing OER and online education technologies. Much of this work has focused on compulsory education, including significant support by the Gates Foundation for initiatives such as the Khan Academy.

Profile of students

Figure 3: Coursera survey data of prior level of education, January 2013



Enrolment on MOOCs continues to be strong even as the number of courses and institutions offering xMOOCs in particular has increased. Although few courses now exceed 100,000 registrants, xMOOC courses continue to regularly attract anywhere between 20,000 and 60,000 initial registrations (see Figure 5). In terms of total figures, the total volume of registrants on the xMOOCs platforms has grown rapidly over the first year of operation as the number of courses and their profile has grown. For example, one year from its launch in April 2012, Coursera had attracted over three million registered users to its platform.

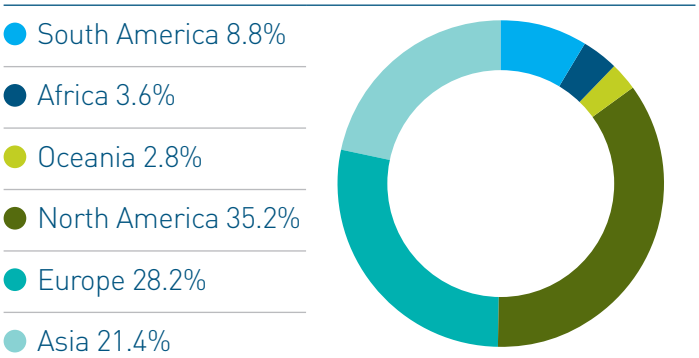
However, to date there is limited data available on students who are enrolling in MOOCs. cMOOCs tend to be populated by networks of advanced professional specialists but few general conclusions can be drawn. Coursera has collected survey data on students participating in its classes (see Figure 3). Over 80% of students who responded to surveys had at least a first degree and over 40% had a masters or doctoral degree, with a notable number enrolled at higher education institutions. Many students have enrolled on the basis of professional interests and objectives, but 'hobby' learners still tend to form the largest group on most courses. In addition, depending on the level of the course there are also a small but notable number of pre-18 students who may be considered prospective students.

Learner backgrounds

- **Vocational learners:** professionals looking to maintain their knowledge of a field or explore new areas in order to develop their careers through flexible and lower cost independent learning models
- **Educators and researchers:** education professionals using MOOCs and their resources in their own or other academic fields as open educational resources for reuse and remixing in their own work with students
- **Higher education students:** enrolled students accessing MOOCs as learning and teaching resources as part of existing courses utilising video lectures, reading lists and other open educational resources
- **'Hobby' learners:** the long tradition of adults engaging in their own self-directed programmes of study, now able to capitalise on the various 'open web' initiatives such as Wikipedia
- **Prospective students:** potential students who are looking to explore different course options and assess if a course may be a potential fit, or who may come to be inspired to embark on more formal studies

MOOCs have attracted highly international enrolments, despite the vast majority of courses being taught in English by US institutions. January 2012 figures from Coursera illustrate the international pattern of enrolments (see Figure 4). This pattern was also evident in the Open University's OpenLearn platform: after its first 18 months of operation to 2008, 69% of people accessing the site came from outside of the UK. Many MOOCs have seen particularly high enrolments from India, especially in science and technology courses. For example, after US enrolments, the largest number of enrolments for the Artificial Intelligence Planning MOOC run by the University of Edinburgh in early 2013 came from India (followed by Brazil, Spain, the UK and Russia).

Figure 4: Coursera data on location of learners, January 2013



Open online pedagogy

MOOCs are typically designed so that they can run with minimal academic support, with most of the costs incurred up front at the development stage. MOOCs share basic pedagogical approaches that enable large numbers of students to participate flexibly through online technologies that avoid the need for the class to meet in one physical location at the same time. In practice many of the technologies and pedagogies that underpin MOOCs have been available for a decade but are now accessible to a greater range and volume of users and producers at a lower cost. The xMOOCs have their roots in campus learning management systems, with courses based around an accessible structure of video lectures, automated assessment and supporting message boards and resources. The 'connectivist' cMOOCs tend to be independent initiatives set up by academics which use various online resources to act as a focal point for networks of specialists with shared interests. The course may be paced with intermittent lectures and assignments but the principal mode of learning is through distributed peer networks sharing knowledge and experience via a range of online resources.

Both types of MOOC achieve their scalability by limiting synchronous learning opportunities and personalised academic feedback to students. Although courses are typically paced around a weekly structure, the online course management systems allow educators and students to share and access relevant resources and exercises in their own time. In addition both models either dispense with feedback and assessment entirely, emphasising participation in the course, or build in automated or peer assessment exercises. xMOOCs in particular use automated multiple choice quizzes, often at the end of short video exercises, to support knowledge retention, as well as for final course assessments.

Both models make heavy use of peer learning as part of the delivery of courses. cMOOCs actively restructure the relationship between the course leader and students, emphasising a much flatter relationship with a more prominent role for input from the course participants, who may hold professional knowledge or creative perspectives. The basic xMOOC template is based around a more hierarchical relationship between an expert communicating knowledge to a relatively passive class. However, courses are also increasingly making use of peer learning in lieu of personalised feedback and synchronous learning opportunities with the course leader.

The two MOOC models have different emphases in terms of their educational objectives. For example, the broadcast xMOOC model allows advanced learners to rapidly gather an understanding of

propositional knowledge required to understand and navigate a particular discipline or field. Whilst the model is basic and may not be suitable for all courses or represent leading pedagogical practice, it is accessible, flexible and scalable to large volumes of diverse students. The more distributed (cMOOC) approach to learning may be more suitable for creative subjects or advanced professional fields where social networking can encourage creative dialogue or sharing of professional practice. The distributed model also increasingly reflects the skills required for professions in which digital technologies have already transformed production and dissemination.

Quality assurance

MOOCs are designed around the basic academic components of curriculum content, learning process, outcomes and assessment. All courses run at mainstream higher education institutions are subject to institutional quality review processes. The main xMOOC platforms also retain quality control rights to ensure that courses conform to a required structure and quality of materials. The edX platform requires courses to be submitted to a quality review process before being posted as an edX course, whilst Coursera reserves the right to withdraw courses that do not adhere to its required standards. cMOOCs are typically independent initiatives subject only to internal review processes but have less conventional structures that may not fit with standard quality assessment models.

There is also an increasing exchange of information online about the quality of student experiences in MOOCs that reflects a wider trend toward a student centred approach to the assessment of course quality in higher education. In the case of MOOCs, students are able to personally review and compare different courses without the usual barrier of cost and make judgements about courses. Furthermore, examples of poor courses have quickly received a lot of attention, with reports of problems regarding peer review exercises, plagiarism, poor materials or course design quickly circulating on the web. These have resulted in one or two courses either being withdrawn or certain elements being halted in short order.

xMOOC enrolment

One of the main criticisms of xMOOCs is that their basic broadcast pedagogical model relies on 'talking head' lectures with very limited or no support and feedback for students. The often-valid criticism of this mode of delivery has been compounded by high attrition rates between the initial registration numbers and the numbers who complete the final stages of a course. These levels of attrition raise questions about the viability of MOOCs as legitimate models of higher education. However, even with high rates of attrition, the absolute rates of completion are often still high. For example, the majority of the MOOCs that have made data available publicly have had over 1,000 students complete a course (see Figure 5).

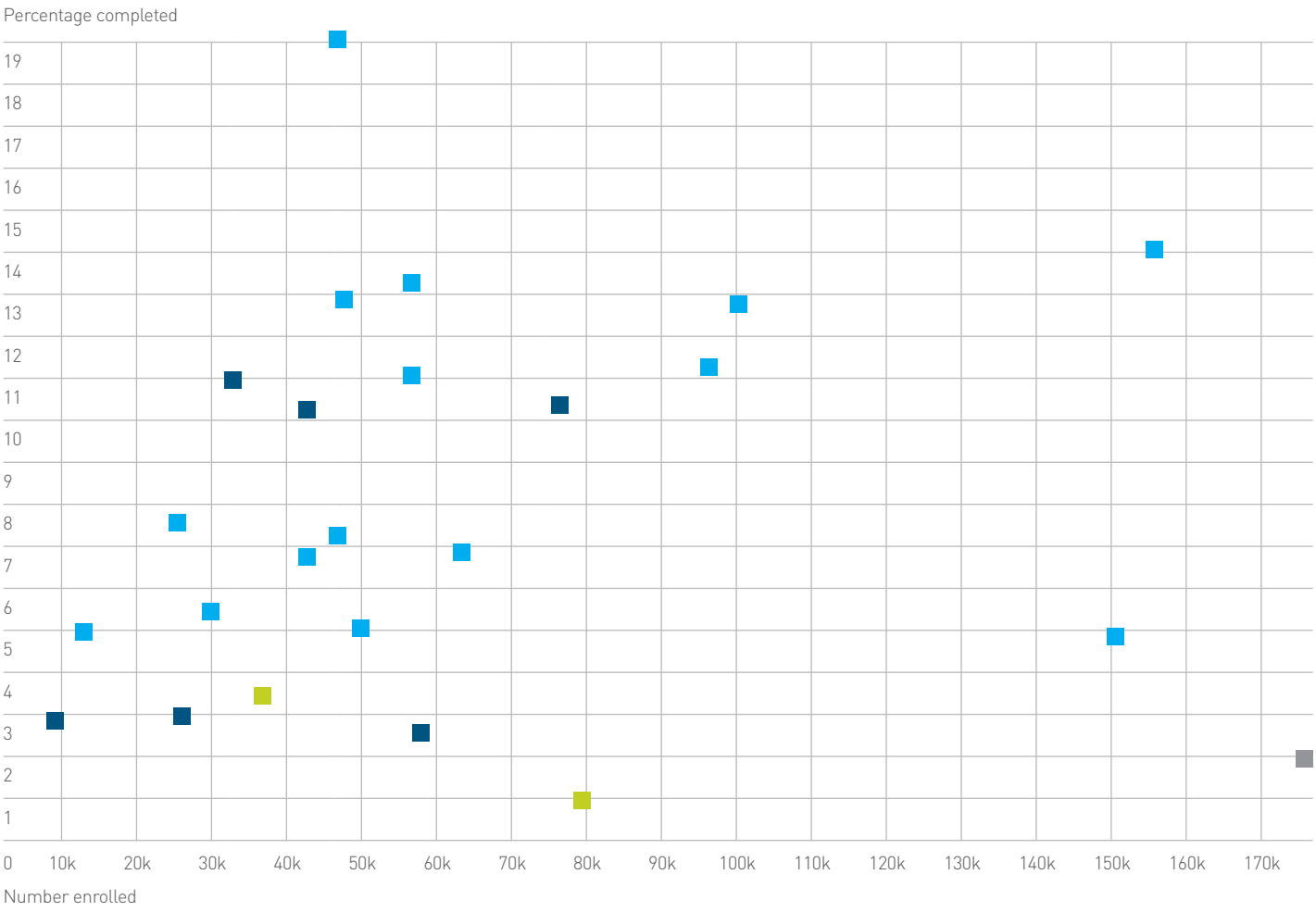
Analysis of enrolments in MOOCs needs to take account of different approaches amongst students towards these kinds of courses. Fundamentally, MOOCs, as 'massive' courses, are deliberately designed to enable a large volume of students to enrol and engage with materials in a flexible manner. And, as students have not paid an upfront fee, there is also less financial impact associated with not completing a course.

Analysis of three coumputer science MOOCs conducted by Stanford academics suggested that there are four high level patterns of enrolment in courses[7]:

1. **`Completing':** learners who complete the majority of the assessments offered in the class, similar to a student in a traditional class
2. **`Auditing':** learners who watch video lectures and follow the course for the majority of its duration but do few if any assessments and don't obtain course credit
3. **`Disengaging':** learners who do assessments early in the course but subsequently have a marked decrease in engagement, typically during the first third of the class
4. **`Sampling':** learners who watch video lectures for one or two assessment periods either at the start or when the class is already fully under way

7. For further details see 'Deconstructing Disengagement: Analyzing Learner Subpopulations in Massive Open Online Courses', available at: http://rene.kizilcec.com/wp-content/uploads/2013/02/Kizilcec-Piech-Schneider-2013-Deconstructing-Disengagement-Analyzing-Learner-Subpopulations-in-Massive-Open-Online-Courses.pdf

Figure 5: MOOC completion and assessment rates, March 2013



Analysis by Katy Jordan, Open University

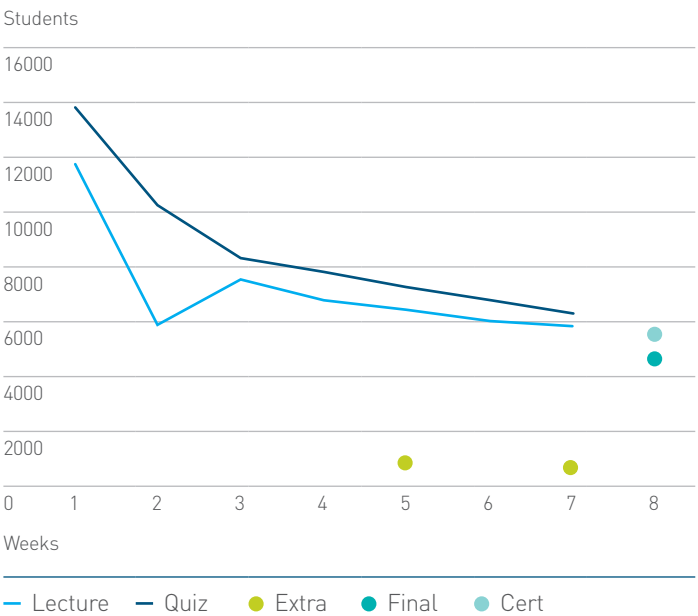
These categories suggest that the flexible design enables MOOCs to cater for different types of students within one class. The flexible structure allows students to dip in and out of a set of educational resources that are 'curated' into a structured programme, including after the course has finished. In addition, the design of courses, including peer learning opportunities, assessment and certification also provides some students with a more engaged experience and concrete learning outcomes. However, there are various factors that can undermine students' learning experience that may be exacerbated by the lack of personalised support and feedback offered in MOOCs. These include poor course design, limited time or motivation to continue a course, and studying in a non-native language.

Analysis of open source data conducted by Open University researcher Katy Jordan shows that, at time of writing, the largest reported MOOC had attracted 180,000 registrations (see Figure 5). The majority of courses that have broken the 100,000 barrier to date were part of the initial wave, with the majority of courses attracting between 20,000 and 70,000 registrations.

Of the initial enrolments, the total number of students who tend to complete a course can reach 20% but the majority of courses have a completion rate of less than 10%. There is no apparent correlation between course length and completion rate. There is some evidence that peer grading can result in a greater level of drop outs, probably linked to the greater degree of commitment required from students, as well as language and confidence issues. Other factors may include the level of the course and complexity of the subject.

Data from the University of Edinburgh's initial set of MOOCs that ran in February 2013 illustrates the diverse patterns of enrolment and retention on different courses. For example, Equine Nutrition had an initial enrolment of 21,500, which translated into 15,100 students in the first week with 6,120 still active at the end – 41% of students who were active in the first week. In contrast, Artificial Intelligence Planning, a masters-level course, enrolled 29,400 which translated into 10,800 students in week one and 741 at the end of the course – 7% of the initial active enrolment. Finally, the Astrobiology course had a larger initial enrolment of 39,000. However, whilst only half were active in the first week (18,300 students), 43% (7,840) were still active by the final week.

Figure 6: Course enrolment patterns, 'Internet History, Technology, and Security', Dr Charles Severance, University of Michigan, Coursera, September 2012



Some courses have made more detailed information available about patterns of enrolment and participation throughout the life of the course. Figure 6 shows enrolment in the Internet History, Technology, and Security course taught by Dr Charles Severance of the University of Michigan on the Coursera platform. The course ran during September 2012 and shows a pattern reflected in other courses (see for example Duke University's analysis of its Bioelectricity course, available online). Of 46,000 students registered for the course, 14,000 watched the first lecture, followed by a steady decline in the number of students viewing resources and taking exercises as the course progressed. The dip in numbers participating in assessment in week two was linked to a problem with the design of a peer assessment exercise that was subsequently resolved following consultation with the class.

The figures show that over 5,000 students completed the final exam and just under 5,000 received a certificate of completion. Whilst these figures represent only 10% of the original enrolment, the total numbers completing the course are more than many institutions may teach across a whole first year undergraduate intake. The figures also show that a cohort of 600 highly committed students participated in an extra credit assignment. Similar cohorts have been seen in a number of other courses that have included synchronous learning opportunities or more complex peer-based exercises. However, in order to sustain enrolments and to avoid problems of scalability, these exercises are typically not included as part of the core course design or requirements.

Experimentation and innovation

MOOCs are also testing grounds for the development of online learning practice and the potential of open and scalable approaches to education. Many courses are increasingly breaking down distinctions between x- and cMOOCs and between online and physical classrooms. Various independent MOOCs run by academics and departments are exploring new ways of engaging with students and wider networks in a way that might not be possible in paid-for courses, whilst also allowing examination of how existing online practice translates into high volume courses. In addition the use of open source software and free web resources has allowed course leaders and participants to mix and match depending on their own needs and the attitudes and practices of the course network.

Academics running courses on the main xMOOC platforms have also experimented with different pedagogical models. Many have experimented with online tools, open educational resources and new ways of engaging students and encouraging critical dialogue beyond the basic video broadcast model. For example, the Digital Cultures course from the University of Edinburgh on the Coursera platform drew on cMOOC principles by dispensing with the more conventional video lecture format, focusing on sets of resources for use each week alongside exercises and student contributions. Courses on edX have also incorporated a variety of new web-based learning resources, such as an interactive electronic circuit builder and molecular manipulator, and intend to make the software open source for use in other online courses.

Some experimentation in MOOCs is focused on ways of blending the online and physical classrooms. For example, some MOOCs run alongside more conventional campus-based classes. Some courses actively use the MOOC for campus students to access resources and assignments, freeing up time for in-class discussion and problem solving. Other examples, such as Modern and Contemporary American Poetry (led by Professor Al Filreis of the University of Pennsylvania), have then taken this a step further by recording the discussions held in the physical classroom to give online students an opportunity to observe a text or assignment being dissected by students and an academic. The Department of Media at Coventry University has integrated both of these strands and cMOOC principles by introducing an online distributed element into certain undergraduate modules (see PicBod and Phonar case study).

Some courses are also starting to explore ways of providing greater levels of personalised support. However, there remains a significant challenge in being able to provide personalised support in a way that is scalable to the volume of students without incurring extra costs beyond the cost of setting up the course. Teaching assistants and/or the course leaders typically provide general course support in MOOC course forums, however maintaining personalised support based on a student-staff ratio incurs extra costs as the number of students increases. In order to circumvent this problem some courses are attempting to encourage alumni to participate in courses to help provide additional support and guidance for students.

Other methods of scaling support are also available, such as pyramid discussion groups, but have not yet been applied widely or effectively in MOOCs.

PicBod and Phonar at Coventry University

Coventry University's Department of Media has pioneered a blended approach that introduces an open and distributed element to its undergraduate courses.

In January 2009, the new BA hons photography course needed to improve the student experience and its graduates' employment prospects while raising the international profile of the course and the university, without increasing costs. Rather than attempting to lock content away behind proprietary protection, the department made the course open and available to all and encouraged students and non-students, including experts and alumni, to engage with it.

Coventry University hosts the live and paid-for version of the course that enables a one-on-one mentored experience and makes full use of all the university's facilities. The course enables students to engage with a global community of participants, enabling them to locate their work alongside different professional networks. This also gives students the opportunity to develop professional relationships during the course of their studies. The online manifestation of the class is at www.phonar.org

In keeping with the open approach, the online version of the course runs on a Wordpress blog rather than an institutional site. The class blog acts as a hub for the course, aggregating tagged (the tag being #phonar) content from different social environments. By using open platforms, search engines promote the work of the course (including the work of the students) for free, including 21% of visits from Google searches. The course uses existing online architecture, such as Flickr, Vimeo, SoundCloud or Facebook, for all aspects of the class so that it replicates participants' online habits. The course has also devised an iPhone app, which has been downloaded over 2,000 times, to make it an active mobile tool.

Learning management systems

The scope for innovation in MOOCs is also in part determined by the capabilities of the learning management system. Non-proprietary and free web resources are potentially the most flexible approach but often rely on course designers integrating various different software components into a structured course. The edX course management system and learning resources software has been made available to developers on an open source basis that may encourage further development of its capabilities. There are also examples of experimentation with the capabilities of the Coursera platform, with both good and bad results. edX also allows courses that do not go through its centralised quality process to be branded as 'Edge' courses, potentially allowing greater flexibility and innovation in course design.

The main MOOC platforms are part of an increasingly crowded free and open source learning management system landscape. These platforms provide firms, developers and educators with testing grounds for new online education practices and technologies, such as scalable distributed learning and technology solutions. Pearson, Blackboard and Google have recently launched online learning management system software that can be used by educators to develop MOOCs and other online courses for free. Blackboard's Course Sites open course series is also providing MOOCs focused on online learning design. In addition there are also open source learning management systems and software initiatives such as Moodle and Sakai that are already being used and supported by many UK higher education institutions and academics.

Course credit and credentials

Models of credit recognition

- **Recognition of prior learning:** incorporating prior learning into the assessment of a prospective student's application
- **Articulation and credit recognition:** recognising previously completed education against the learning outcomes, process and assessment standards of the receiving course to count as credit toward an award
- **Licensing:** integrating MOOCs or other high volume online learning courses provided by third parties into the core teaching programme of a structured course, leading to course credit and a higher education award
- **Reciprocal arrangements:** sharing online courses across multiple providers that are structured in various ways into the learning process and outcomes of programmes and higher education awards

Policy makers and the main platforms are increasingly looking at ways of formalising recognition of MOOCs to enable students to use courses in their academic and professional development. This responds to demands from committed students for some form of award for successful completion of the course and wider interest in the potential role that the low cost, high volume model of delivery may play in higher education. To date this has largely focused on raising the standing and profile of MOOCs – and successful students – with employers, and developing models of credit recognition by higher education institutions. The development of higher standards of validation and credit recognition are likely to be an important element of the main xMOOC platforms' efforts to become financially sustainable.

At present most MOOCs provide students who pass the course with a certification of completion for free or for a small fee. The basic xMOOC assessment model relies on automated testing, usually supported by an 'honour code' that sets out standards of conduct for participating students. Some courses also make some use of peer assessment for more complex exercises. xMOOC providers are also developing paid-for assessment options that provide a higher standard of validation. The basic model is a proctored examination at a physical location, offered in partnership with an external provider with a global network of local facilities. Platforms are also developing automated remote validation services, for example the Coursera 'Signature track', which uses typing style to identify students.

In the case of xMOOCs, the platform, rather than the higher education institution that has developed the course, awards the certificate of completion. Early indications suggest that certificates are popular amongst students that complete the courses and that paid-for validation options are likely to be attractive to a significant proportion of these students. In addition the xMOOC platforms are offering careers services to students and employers on the basis of performance on their courses. Some platforms, including the Open University's OpenLearn, are also experimenting with 'badges' that can be integrated into professional profiles on career orientated social networking platforms such as LinkedIn.

American Council for Education CREDIT scheme

The ACE CREDIT scheme was established in 1974 and has a network of 2,000 higher education institutions that consider ACE credit recommendations for transfer to degree programmes. The scheme connects workplace and other types of learning with colleges and universities by helping adults gain access to academic credit for formal courses and examinations taken outside traditional degree programmes. The scheme acts as a clearing house for assessment of these courses, avoiding the need for each institution to make its own full evaluation of the quality, assessment and learning outcomes of a course.

MOOCs are also being recognised by institutions for academic credit. A number of US institutions have recognised MOOCs for credit on an individual basis or as part of structured credit recognition schemes. In February 2013 the American Council for Education (ACE) recognised a small number of MOOCs provided by Coursera as part of its credit recognition programme, CREDIT. Students from around the world who have received a validated certificate of completion from recognised courses can use their certificate when applying to study at institutions that are members of the CREDIT network and potentially have it count toward a final award. The CREDIT programme is also reviewing additional courses for possible recognition alongside a wider programme of work investigating the quality and learning outcomes of MOOCs.

MOOCs have not yet been recognised for credit on a systematic basis by UK higher education institutions. Individual institutions may assess a student's prior learning for entry onto a course and potentially allow a student to articulate onto different stages of a course, with prior learning counting toward the final award. Assessment is carried out on a case-by-case basis based on the learning outcomes required for the course including its volume, process and intellectual demand. In England, the process for recognising prior learning is covered by the Quality Assurance Agency's quality code and guidance on academic credit arrangements, and Scotland, Wales and Northern Ireland have equivalent frameworks in place. In practice the frameworks are 'Broad, overarching and advisory, allowing higher education institutions to adopt and adapt elements as appropriate to their needs and circumstances'[8].

Other formal credit recognition and articulation arrangements have also been established between independent online providers (such as Straighter Line) and higher education institutions in the United States. Similar to the ACE CREDIT model, these arrangements allow students to complete introductory courses independently and at a lower cost that can subsequently be recognised for credit toward a full award at a participating higher education institution. In the past, articulation arrangements in the UK have typically been orientated toward students moving between higher education institutions. However, comparable arrangements are developing in the UK around face-to-face pre-sessional courses for international students taught by third parties who can then move directly into credit-bearing portions of a higher education programme.

Some MOOCs from Coursera and Udacity are also being integrated into the courses and awards of third party institutions. These build on experimental models in which open online courses have been included as part of campus-based courses, typically by the academic team that ran the MOOC. Building on this approach, a licensing arrangement allows an institution to purchase the right to include a MOOC as a formal part of its curriculum. Under this model satisfactory completion of the MOOC would count alongside other course modules toward a final award at the student's home institution. This model typically establishes a contractual relationship between at least two education institutions as well as an online provider and commits partner institutions to maintain a course for a certain period of time.

Other models being developed by online providers such as 2U or Academic Partnerships involve reciprocal arrangements that enable students to study online courses offered by partner institutions to count directly toward academic credit. These models do not tend to include fully integrated components of a teaching programme but establish frameworks around which online courses can be selected as part of different awards. In the case of 2U these courses are offered for a fee and may be selected alongside full modules taught by the home institution. Students are then free to select their modules, including online distance courses offered by partner institutions with or without additional support at their home institution, or on a more structured, supported basis. In the academic partnerships model the course is free but the eventual credit is provided for a fee.

8. For further details see Higher education credit framework for England: guidance on academic credit arrangements in higher education in England (August 2008) and the equivalents in Scotland and Wales. Available at: www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/creditframework.pdf

2: RESPONDING TO THE DIGITAL CHALLENGE

The growth of MOOCs has driven an expansion in enrolments in online distance learning around the world. However, the high level of interest in MOOCs also reflects the potential for a wider transformative impact similar to that experienced by other sectors that have gone through digital transitions. For example, in the newspaper industry, online content developed alongside more conventional print outputs until a tipping point, in part linked to increasingly mobile internet connections, was reached. Since then there has been a rapid and increasingly radical restructuring of the industry. In higher education the model of free, accessible and flexible delivery through third party platforms using broadcast and distributed peer learning represents a new relationship between academics, students, institutions and technology firms. A decisive shift toward this model would represent a significant change.

The shift to digital has had major impacts on assumptions and practices across a variety of sectors. In some cases online technologies have opened up a new sub sector, such as internet search or social networking that has provided new companies such as Google or Facebook with the platform to become major players in the wider software sector. In other cases there has been a restructuring of traditional sector boundaries. For example, the BBC's online offering is in direct competition with national and local newspapers, whilst Apple, an electronics and software firm, is now the dominant player in music retail. In retail new entrants such as eBay and Amazon have become dominant by aggregating multiple sellers, including business and private sellers, into large marketplaces. Google and Amazon have used effective data analytics to provide instant feedback to vast numbers of users without any human interaction, and to develop new and innovative services.

The availability of free content online has challenged many firms to develop new business models in response. In other sectors this has involved developing effective digital rights strategies that strike a balance between permissive approaches that encourage a high volume of users versus restrictive approaches that generate value through sale of content. The trajectory in many industries is toward integrated strategies that blend free and paid-for services, often across physical and online platforms. Blended models require a strategic assessment of different revenue models and modes of delivery, ranging from entry-level free online products through to paid-for physical and premium services, and how they can be integrated in complementary ways. Furthermore, assessments are made against the wider strategic objectives of the organisation, ranging from core values and missions through to sustainable revenue generation.

These changes have wide-ranging implications for the priorities and practices of organisations attempting to bridge the gap between physical platforms and the new digital landscape, posing challenges for leadership and staff alike. The shift to online may require new products and services in order to maintain the sustainability of organisations in the absence of traditional revenue streams. New and existing products and services may engage with new audiences and markets around the world, presenting new challenges and needs. These shifts may require changes to internal practices, such as digital first, real-time news models adopted by newspapers. Very often these new practices require new skills and attitudes from staff to enable them to operate and develop in the new environment and drive the work of the organisation.

The following section looks at some of the main issues that institutions and the sector will want to take into account when formulating their responses to MOOCs and online learning developments more generally.

Supporting educational missions

Free, high quality online courses have obvious potential in terms of supporting an institution's educational mission by reaching a much larger volume and range of students than traditional classroom-based modes. Furthermore, the spirit of open education resources (OER) encourages and enables resources and ideas to be shared between educators and students online in order to advance shared missions collaboratively. In other sectors, organisations have capitalised on the increased volume of potential users attracted to free online content to encourage engagement with other services and experiences. For example, in the music industry, the shift away from physical multi-track albums toward single-track digital downloads has been accompanied by a resurgence in live music. Newspapers often use semi-porous or selective 'paywalls' to allow free news services to sit beside more in-depth analysis or bundled subscriptions for other platforms, including print.

Early institutional entrants into MOOC initiatives have attracted attention through their association with these new developments, which may help to raise their profile more generally and encourage student recruitment. The extent to which this impact will be replicated as the field matures is less clear. However, third party aggregating platforms also act as an online catalogue of courses that is accessible to browsers and determined searchers. This enables institutions to open up their courses to a wider range of students than might otherwise have been attracted directly by their own websites and prospectuses. Many of the more specialist cMOOC initiatives also help to position academics and departments as leaders in their field and attract networks of researchers and professionals to engage with their work and students.

Free online courses can also play a 'try before you buy' role in student educational choice by enabling prospective students to try out courses that may give those institutions that engage students through open online channels such as MOOCs an advantage in recruitment. This may help students to make the choices that are right for them and improve their subsequent experience and reduce drop outs or fail rates. The experience of studying on a course more casually may also encourage a student to consider signing up for a paid-for version of the course. The experience of the Open University suggests that open education resources can drive enrolments to paid-for offerings at a rate of up to 10%. For example, an internal study of the Open University's OpenLearn initiative in 2008 showed that 7,000 people had registered on courses during the same online session in which they were using the OpenLearn site. In addition, OpenLearn was cited as the most effective route for conversion of enquiries into registrations.

Discoverability is likely to be an important factor in the success of platforms and the impact that they have in widening access to institutions for purposes of recruitment. The dynamics of the internet can enable a small number of market leaders to attract new users from across the web. Leading platforms can rapidly scale up to meet this increased demand, as the process of investing in digital infrastructure is less complex, faster, and lower risk than physical expansion. The pace of change also means that previously innovative incumbents can be quickly supplanted by new platforms with a more compelling offer. Nevertheless, the extended reach of online delivery gives greater scope for specialist offerings to reach a critical mass of users. The opportunity to develop and engage directly with specialist communities may also be attractive for some institutions or departments.

Driving internationalisation

The shift to digital models in other sectors has resulted in a significant internationalisation of markets and reach of organisations, and the early statistics illustrate a similar trend for MOOCs. For example, international students (ie those students resident outside the country of the host institution) make up two-thirds of MOOC enrolments, in contrast to 10% of the student population enrolled in UK universities.

The recruitment benefits of MOOCs are likely to be pronounced in the international market. They enable institutions to extend awareness of their work to new audiences, and free courses enable international students to explore options before investing substantial money, time and personal commitment to overseas study. Furthermore, online distance learning will also be attractive to a wider cohort of potential students for whom overseas study might not be a practical option.

The pedagogical model of MOOCs may play a role in the continued development of transnational education (TNE) models, where international students study on UK courses overseas. Higher Education Statistics Agency figures show 113,060 students currently enrolled on UK provision overseas, either through distance or TNE arrangements. This figure is approximately a third of the total number of non-EU students studying in the UK. MOOCs may facilitate the development of these models by allowing lower-cost engagement with academic staff at the home institution, with overseas sites providing additional support to students. MOOCs could also help prepare students prior to a period of study in the UK or as part of collaborative reciprocal arrangements with overseas providers.

An acceleration of internationalisation linked to a shift to online presents both risks and opportunities for institutions teaching in English. English is the leading international language, bringing together learners from a variety of national and cultural backgrounds. Whilst there is an increasing number of courses now being offered in Spanish and French, English remains the most popular language of study. However, the English language also brings UK higher education institutions into direct competition with the US sector, which has already moved more decisively toward a free course model. This means that the UK sector is likely to have to respond to these developments more quickly than providers offering courses in other languages. Non-English providers may be more insulated and have the opportunity of providing courses in languages not catered for by US or UK institutions.

Diversifying learning pathways

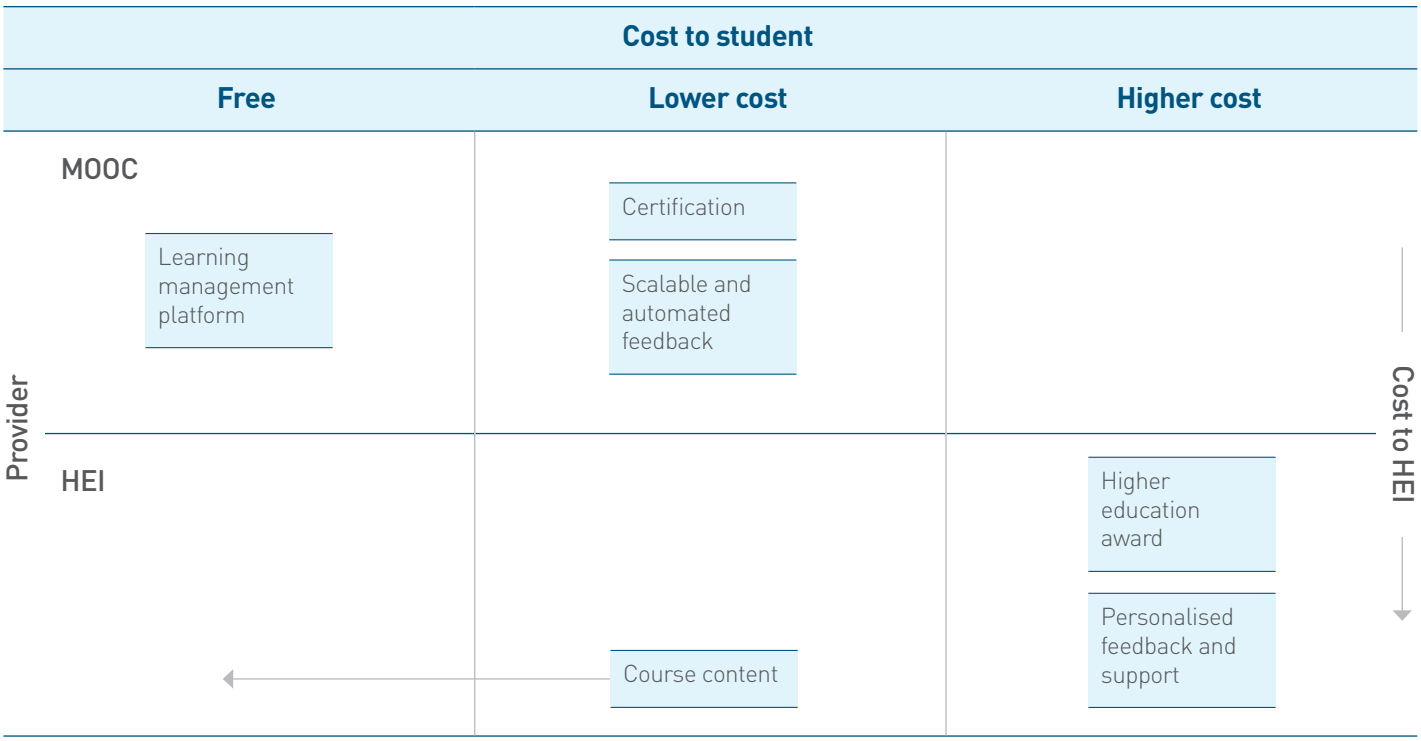
The proliferation of MOOCs has diversified the options available to students as part of a wider trend of diversification beyond traditional institutions, such as universities or media organisations, to include sources such as Wikipedia, blogs and 'alternative media' websites. MOOCs expand the opportunities for students from different backgrounds to engage in lifelong learning. In particular, flexible pathways may help to support the ongoing development of individuals already in the labour market and play an important role in meeting the challenges of equipping the labour force with the skills needed for advanced knowledge economies. This is particularly relevant in the context of the decline in part-time student enrolments, which raises questions about the attractiveness of existing models of flexible part-time provision.

There is a potential synergy between open flexible models of delivery and conventional models of higher education. As standalone courses MOOCs currently provide insufficient support to develop the same cognitive and procedural skills needed by many students and employers. Institutions may find benefit in considering how their courses and awards can integrate independent prior learning pathways into a more rounded educational experience. This approach may be particularly attractive to vocational, part-time and international students. However, free courses provide different sorts of learning experiences, such as basic content or more complex distributed structures and outcomes. As these courses may not exactly replicate courses that are offered by higher education institutions, the sector will need to consider how best to assess the learning process and outcomes of different MOOCs.

Institutions may also want to capitalise on the potential benefits that can be accrued from their own staff and students participating in MOOCs offered by other institutions and organisations. Institutions and academics may explore ways of integrating MOOCs into the delivery of courses on a formal licensing or an informal basis. Users and producers of courses will need to consider the licensing arrangements associated with the course and the various resources that may be used in them. For example, courses on the main xMOOC platforms are covered by proprietary terms and conditions; however, some of the resources used by course leaders on these platforms may be made available as OER. Furthermore, creative commons licensing standards are increasingly important for institutions and academics in order to ensure that materials can be used and shared without infringing intellectual property and copyright.

Restructuring costs

Figure 7: MOOCs and the evolving costs of higher education



A crucial feature of disruptive transitions to the web in other sectors has been the vastly increased scope for users to substitute different services from providers anywhere around the world. This has often accelerated competition by bringing a variety of new entrants into what may have been previously stable markets dominated by a small set of incumbents. In particular, this choice means that free-at-the-point-of-use models can rapidly gain a competitive advantage over paid-for offerings. The introduction of free-at-the-point-of-use models has applied downward cost pressures on organisations as they attempt to streamline their operations in response to the reduced cash value of their output, particularly content. Furthermore, attempts to monetise free-at-the-point-of-use models and make them sustainable have often proved elusive, or altogether out of reach, for many businesses.

As many aspects of higher education cannot readily be substituted online for free alternatives, particularly the provision of qualitative academic support and the right to award higher education qualifications, any digital transition may be quite different from those experienced in other sectors. However, the development of free models of online learning may still have implications for the tuition-based revenue model of most higher education institutions.

In particular, the model of open online learning is currently developing around the unbundling of four of the components of higher education and offering some of these for free or at a lower cost to students:

- **Content:** structured open online courses give access to leading propositional knowledge and student networks from around the world for free to the student and at a scalable fixed cost to institutions, particularly those in receipt of research funding.
- **Delivery platform:** xMOOC online learning management platforms bring institutions and their course offerings together in one place at a scale that attracts students who are able to use them for free, but are currently underpinned by venture capital investment with a need for a sustainable business model in the future.
- **Feedback and support:** personalised teaching feedback and support with direct input from academic staff to help students develop knowledge and skills is provided for a fee by higher education institutions, but with a growing role for scalable, low-cost digital techniques and with potential for new entrants offering personal tuition.
- **Awards:** validated higher education awards that are recognised by students, employers and education institutions are awarded for a fee by higher education institutions but with a growing variety of lower-cost certificates and badges being offered by online providers.

In higher education the 'digital rights question' concerns the extent to which free open online courses are recognised by third party institutions for credit, enabling students to receive an award for a lower cost. These approaches decouple the expense of producing academic content from the value that can be generated through the legal right to award higher level degrees. As a result the value that institutions are able to generate from different aspects of their work, such as lectures, may shift in comparison to other areas, such as personalised tuition. In some cases the full 'bundled' experience will retain its value. However, the impact of unbundled approaches is likely to be most pronounced where students are already more advanced, need less direct face-to-face support and lose earnings whilst studying, such as those taking postgraduate taught courses.

In this context institutions will need to monitor carefully how the new 'unbundled' and free landscape evolves to ensure that students continue to be attracted by what an institution offers. Students may increasingly be able to tailor a personalised approach to their learning that suits their needs whilst new entrants may be able to position themselves to offer certain elements in attractive ways. Options may include obtaining academic content through broadcast MOOCs for free with validated examinations and certification at a lower cost. Furthermore, the value of MOOC certificates may also grow in their own right if they become established methods of validating learning for students and employers. Personalised feedback and formal higher education awards will continue to attract a fee but alternative providers may offer intensive models of tuition at a lower cost.

Sharing education services

Institutions may also need to think further about the opportunities that are presented by the use of MOOCs and their methods in light of the challenge that an unbundled and restructured 'value chain' in higher education would pose. The main xMOOC platforms, and the other offerings coming online, already provide a shared service for institutions wishing to make courses available online for free. The main MOOC platforms already provide a shared service for institutions wishing to make courses available online for free. Licensing and reciprocal arrangements also point to the potential role that MOOCs may play in more conventional models of higher education. MOOCs may enable institutions to provide content to their students that might otherwise have not been possible due to the location of an institution or the volume of original research that it supports. Additionally, the use of MOOCs may help institutions to free up costs in order to direct investment into improving their offer to students.

The strategic use of shared MOOCs may allow for the development of shared education services that reduce duplication of certain courses and materials. Institutions may enter into collaborative arrangements with one or multiple partner institutions. Content may be shared between institutions or departments in order to avoid duplication of certain types of core academic content, such as first year undergraduate courses, or technical modules that have little scope for interpretation. This content can also be delivered in ways that reduce pressures on physical space. For example, the University of California is experimenting with online provision

that will enable students to study single versions of core subjects across the whole system. This has been developed in response to increased state budget pressures in California and in its university system.

Driving learning research and development

With the shift to online learning, higher education institutions will need to develop their online education practices. MOOCs are providing institutions and academics with an opportunity to explore evolving formats, refine online pedagogies and course design, and develop skills and competencies in online learning across the institution. Many institutions will already operate online learning provision; nevertheless, the various types of MOOCs also represent opportunities for academics to experiment and develop open and scalable approaches to online learning and teaching.

Proactive 'experimentation' with x- and cMOOCs may help institutions to respond to rapidly developing digital cultures and communities of practice outside of the traditional academic and institutional models.

New learning technologies are also likely to continue to present new opportunities and challenges for institutions and have implications for the design and delivery of courses, and produce new models of delivery. These technologies can improve knowledge of the learning process, thereby improving course design, whilst also extending the ability of educators to deliver a more rounded online learning experience (see 'Emergent learning technologies' text box). For example, technologies such as learner analytics collect data on individual and cohort learning patterns and associations, made possible by the use of digital software. Similarly, semantic technologies may make automated linkages between course delivery and online resources to support students.

Emergent learning technologies

Analytics:[9] Most virtual learning environments include some basic analysis of learner behaviours, such as the volume of engagement with an online resource. Increased engagement with digital learning environments and resources increases the amount of data that can be collected allowing analytic techniques to be applied in more sophisticated ways to improve the feedback to students and structure their learning.

- **Adaptive learning** develops a model of a learner's understanding of topics and concepts, allowing detailed feedback on progress and providing personalised pathways to reach learning outcomes.
- **Social network analysis** provides tools to make online class and student networks more visible in order to help guide more effective learning, linkages and engagement.
- **Discourse analytics** enables better assessment of the quality of contributions and connections that a student may make during their time on a course, including outside of formal class structures.

Semantic web technologies:[10] automation of personalised support to construct knowledge by enabling technologies to make informed linkages across the web on the basis of labels and tags. Applied to education, this technique may enable programmes to identify resources of interest to students enrolled on a particular course in a more targeted and automated way, including, for example, location-specific learning opportunities. This augments the signposting role of the educator by enabling students to independently capitalise on the size and scope of the web.

Virtual problem-based learning:[11] development of procedural skills by using technologies to enhance problem-based learning approaches through immersive, experiential virtual learning environments. These models combine problem-based learning with techniques developed through computer games and other simulation programmes and can bring students and educators together from multiple locations. This can enable a variety of skills to be taught, ranging from basic foundation techniques through to more complex exercises.

9. For more information see: Learning analytics: UNESCO institute for information technologies in education. Policy brief November 2012, Simon Buckingham Shum: http://iite.unesco.org/publications/3214711/

10. For more information see: Jason Ohler, 'The semantic web in education' Educase Quarterly Number 4 2008: http://net.educause.edu/ir/library/pdf/eqm0840.pdf

11. See for example the work of the Serious Games Institute at Coventry University: www.seriousgamesinstitute.co.uk

Learner analytics are reliant on collecting large volumes of learner data through digital platforms to establish indicators and associations that guide automated feedback to students. In light of this, learning management systems, including those used by aggregating course platforms, are likely to play an increasingly important role in the development of analytic technologies. The experiences of other sectors suggest that analytics can rapidly drive new business and services. For instance, Google and Amazon have established and maintained dominant market positions that have enabled them to monopolise the data that underpins continued development of cutting edge services that attract users.

These types of technologies are in their infancy but as they mature and their cost lowers they may play a significant role in the full range of higher education provision, including both campus-based courses and MOOCs.

Reforming the core

In other sectors the shift to digital has resulted in significant changes in practices and processes that can produce tensions between the different facets and priorities of an organisation. Many newspapers have moved away from the traditional daily news cycle toward a digital first approach that requires them to operate in ways that are closer to 24-hour news channels. Stories are posted on websites in real time, with additional live commentary services and reporting happening throughout the day. Broadcast has also shifted from being tied purely to schedules toward integrating non-linear services, such as websites, requiring programmes to operate across multiple platforms. Furthermore, the growing role of user-generated content, from message boards through to citizen journalism, has presented new challenges to the style, standards and legal responsibilities of news organisations.

Institutions will need to consider how online technologies and practices can enhance the educational outcomes and experience for students across all of their courses. The demands for effective online elements are increasingly driven by the expectations of students.

The example from the Department of Media at Coventry University shows how the pedagogical model of core undergraduate courses can capitalise on the potential of online methods to improve learning outcomes and the student experience. This approach was born out of the experiences of dramatic change brought about by the shift to digital media, and prepares students for the reality of their future careers by actively capitalising on the networking opportunities of the new digital landscape. Indeed, many of these lessons transfer to a range of academic and vocational fields, from the arts and sciences through to journalism and academia.

Institutions will also need to consider how the development and application of online approaches require changes in the processes and procedures that underpin their mission. This may require a careful balance between the different aspects of an institution's work, including online and physical, free and paid-for provision. Adapting to diversified learning pathways and new online pedagogical models may necessitate new quality assessment and assurance processes that enable the institution to develop distributed models of delivery whilst maintaining academic standards and a high quality student experience. Different forms of online provision may result in a variety of different arrangements with students on different modes of study. Institutions in other sectors have also had to make significant organisational changes to be effective and sustainable in the new operating environment.

The shift toward online may also demand the development and refinement of new and existing skills to continue to produce courses that give additional value to students. The skills required to deliver online courses effectively may have different emphases from those required for conventional courses, needing altered presentation skills and the ability to liaise with students remotely through text-based communication and social networking. The use of data to understand learning may need to be strategically integrated into the core business of an institution, requiring new skills in academic departments and corporately. Furthermore, institutions may also need to enhance their capacity to monitor and adapt to new developments in online learning and other technology spaces as their work online develops.

3: MAKING THE MOST OF MOOCS

The development of MOOCs has been rapid and their long-term impact on higher education is not yet clear. The initial wave of interest may be driven by marketing, the excitement associated with innovation and the presence of a small number of leading institutions. At this stage much of the development is relatively peripheral to the core work of higher education institutions. The majority of students who are studying on courses are doing so out of general interest, and although interest in credit is strong this is not yet the driving factor behind enrolment. MOOCs are often instruments used to raise the profile of institutions and academics and encourage student recruitment. Furthermore, the revenues generated by MOOCs may ultimately be limited to simply sustaining the operating costs of the platforms.

However, MOOCs may yet come to represent a valuable addition to the higher education landscape in their own right. They may develop as a flexible and scalable model of higher education that is attractive to a variety of part-time, professional and international students. Whether MOOCs become more established depends on how far students, employers and institutions recognise them as a useful approach to the process of education. There are issues around the pedagogical quality of MOOCs due to their scalable model. The resolution of these questions will in part determine the extent to which MOOCs are offered for credit, as viable recognition models have already been established in the US that can be developed further into the future.

MOOCs may also be emblematic of a broader shift in attitudes towards online education that reflects changing patterns of online activity in wider society. MOOCs and other open and online learning technologies may reshape the core work of institutions, from pedagogical models to business models, and the relationship between institutions, academics, students and technology providers. Experience from other sectors suggests that new digital models of delivery can develop rapidly alongside conventional models before attitudes and behaviour shift more decisively toward digital platforms. The continued importance of experiential support and development, and assessment of outcomes may result in a different (ie slower) trajectory of change. However, it is essential that institutions think critically about what the implications of a digital transition may be for them.

In order to respond proactively to these developments, higher education institutions and policy makers are evaluating their strategies against the opportunities and challenges presented by open online education. This process is likely to result in finding an optimal blend between the different free and paid-for online and physical models. These developments present opportunities to advance education missions, drive student recruitment and internationalisation, and develop new pathways into higher education. However, there may also be significant challenges associated with the organisational reforms required to respond to potential shifts in the costs and revenues associated with different aspects of higher education.

Universities UK recommends that institutions consider the following questions:

What are the aims of engaging with massive open online courses?

- **Mission.** What role can open online courses play in communicating knowledge and expertise, and raising the profile of your institution and its departments around the world?
- **Recruitment.** What role can MOOCs play in diversifying recruitment pathways, particularly among students from non-traditional, adult and professional backgrounds and from overseas?
- **Innovation.** What role can open online models of delivery play in improving the quality and value of online and traditional courses for students, employers and society?

What organisational changes do new online models of education require?

- **Sustainability.** What are the costs of developing and running open online courses and what are the wider implications of a shift toward free course content for the sustainability of existing business and pedagogical models?
- **Pedagogy.** How can an institution add value to the educational experience of students beyond free and low cost models to develop different skills, and to facilitate access to a variety of social and professional networks?
- **Credit.** What institutional and sector arrangements should be made for recognising certain MOOCs for entry onto paid-for courses and toward a final higher education award?
- **Capacity.** What is the appropriate balance between rapid, flexible innovation and wider development of professional and institutional capacity to implement new online models of delivery?

There are risks that should be acknowledged around open and online models. Low cost, high volume online models largely dispense with the personalised feedback that gives students a rounded developmental education. In particular, open models are not an answer to widening participation without associated support for students from non-traditional backgrounds. Developments are also bringing UK institutions into direct competition with higher education institutions and technology start-ups from the US that have already moved decisively into this market based on their own pedagogical and business models. The challenge of making higher education financially sustainable in this context is also likely to raise questions about the extent to which technology facilitates and improves higher education, or overly determines its form and function.

Despite these caveats, the open online model has the potential to bring significant benefits to higher education. It enables the extensive knowledge that is developed by higher education institutions to be made available for wider society in clear, structured and flexible ways. It is flexible and low cost, with international reach, helping to make higher education more affordable for students, employers and society. It gives institutions the opportunity to develop pedagogical practices that are attuned to increasingly digital societies. The success of the open online model will ultimately be determined by the quality of courses and the extent to which they are recognised and valued by students, employers and institutions. As world-leading institutions teaching in English, UK universities are in a privileged position to make the most of the global opportunities afforded by open online delivery.

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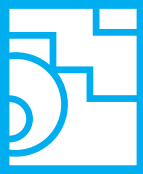

Universities UK

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Woburn House 20 Tavistock Square London WC1H 9HQ

Tel: +44 (0)20 7419 4111

Email: info@universitiesuk.ac.uk
Website: www.universitiesuk.ac.uk
Twitter: @UniversitiesUK

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