TRENDS IN EDUCATIONAL TECHNOLOGIES

Arun Karnad

Trends in Educational Technologies analyses the benefits and considerations of deploying four major technological trends set to affect higher education institutions. These include; MOOCs, BYOD, Gamification and Games-based learning and Learning analytics. The report argues that, while technology can bring benefits and should be embraced by institutions, pedagogy and learning should be at the heart of any technological adoption.

Contents

Executive summary

This report aims to evaluate key technological trends in higher education, and explore the benefits of their use, as well as some of the considerations institutions need to make before their implementation. Horizon scanning techniques were used to identify suitable sources, and trends identified by reviewing state-of-science reports, academic articles, media articles and blog posts by institutions and commentators working in the field. Academic articles and reports were sourced using LSE Library's catalogue and Google scholar, while blogs and media articles were sourced using search engines and hashtag searches on Twitter. Please see the methodology section for further details.

Four key technological trends were identified through this method; Massive Open Online Courses (MOOCs), Bring Your Own Devices (BYOD), Gamification and Games-based learning and Learning Analytics. The use and impact of social media on higher education will be considered separately in a future report.

The summarized findings of this report are as follows:

MOOCs

Benefits

- MOOCs are unlikely to be the disruptive force that it was initially hyped to be. Despite increases in tuition fees and the option of receiving free, online education via MOOCs, a record number of students enrolled on to courses at UK universities in 2013, 9% up from numbers in 2012 (Burns, 2013)
    - Students are still attracted by the opportunities to gain qualifications, experiences and lifelong connections that one gets by taking traditional, taught courses at a University, and MOOCs are unlikely to become a replacement for such courses.
- MOOCs offer flexibility to student and reproducibility for courses which remain unchanged year on year, and could be used to promote the quality of teaching and the values of LSE to a wider audience, particularly to prospective postgraduate, international and corporate audiences.
- Courses could also be tailored towards TNE efforts by producing MOOCs in languages and for topics affecting countries with large numbers of potential students, such as India, South Korea, Brazil and the Philippines.
- MOOCs may generate revenue through front-end services for students, such as offering credentials, career guidance and tutoring.
    - The data generated on, and by students participating in MOOCs could also be used as a revenue source through analytics, consultancy and targeted advertising.
- Tailored online courses, such as SPOCs, could also feature as part of existing corporate programmes, such as MBA programmes, allowing greater flexibility for these students, as well as inculcating vital digital literacy skills.

Considerations

- MOOCs require significant investment in time and resources of academics and support staff.
    - Institutions typically have to invest between $15,000 and $50,000 in to producing a MOOC (Colman, 2013), including around 100 hours of production time and 8-10 hours a week of academic time for teaching (Kolowich, 2013b).
- Producing a MOOC also does not guarantee that learners will sign up, be fully engaged, or learn anything useful
    - The majority of students joining MOOCs may be attracted, or indeed constrained, by factors such as curiosity towards the topic, existing knowledge and qualifications, the reputation of the institute and the time they can commit to the course, rather than an implicit desire for recognised qualifications or career motivations. BYOD and Cloud Computing

Universities UK recommend that institutions should consider the following questions when producing MOOCs (Pg.3, Mehlenbacher, 2013):

- **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?

BYOD and Cloud Computing

Benefits

- Lower equipment costs as fewer desktop units are required
    - Subsequent reduction in energy costs from reduction in on-campus equipment

- Students are often willing to use their own devices to aid their studies, for reasons including the mobility mobile devices offer, the flexibility to exploit learning spaces outside of lecture theatres and classrooms, and the convenience of limiting the number of platforms they need to use (Chen & Denoyelles, 2013; Grussendorf, 2013).
- BYOD and Cloud Computing could allow the continuation of classes through disruptions such as bad weather
- More efficient use of classrooms, by allowing collaborative work through Virtual Learning Environments (VLEs) and forums (Lennon, 2012)

Considerations

- Educational materials are cross-compatible and accessible with both learners' devices and learning needs.
- Institutions wishing to promote the idea of students and staff bringing their own devices will need to consider providing appropriate learning spaces which cater for student and staff needs, including easily accessible plug-points to charge their devices, software licenses for device-friendly specialist software, appropriate internet connectivity and security, both in terms of software and physical security.
- BYOD does not mean the end of providing equipment to students. Institutions will still have to provide devices for students without the means to provide their own.

Gamification

Benefits

- Computer games can be considered to be complex learning environments requiring instructional support in cognitive activities, such as decision-making (Wouters & van Oostendorp, 2013). Pivec, (2007) argues that games-based learning could support a constructivist pedagogy, whilst by allowing students to collaborate, interact in virtual environments (in multiplayer games), manage problems and learn through virtual experiences.
    - Knight et al., (2010) found that such games offered the potential to enhance learning and performance when compared to traditional educational methods.

Considerations for implementation

- Previous studies have shown variable results regarding the transferability of the skills learned through games (Tobias, Fletcher, & Wind, 2014). Tobias et al., (2014) argue that games which simulate the cognitive and motor skills required in real-world situations are more likely to lead to successful learning outcomes than more abstract games.
- Designing games that are accessible to all students, are engaging and lead to positive learner outcomes requires expertise which are often beyond those of the academics interested in using game-based learning, and would probably require external expertise to produce, leading to cost issues (Epper, Derryberry, & Jackson, 2012).

- Some games may be too successful, and may turn in to a distraction for students, or gamification leads to the opposite outcome of trivialising course aspects, such as attendance.
- Institutional infrastructure and equipment needs to be able to handle the requirements of the game or gamified content, and faculty and support staff needs to be able and prepared to produce and maintain games and adapt course content accordingly.

Epper et al., (2012) suggest that academics and institutions must ask the following questions before implementing game-based learning or gamification of courses:

- How does game-based learning align with the overall institutional strategy? Where, specifically, does it produce the greatest effect on achieving primary goals?
- Which university communities or stakeholders on campus have investigated or piloted game-based learning, through which projects? What were their results?
- How to ensure sufficient interest and investment? Which groups on campus are in the best position to become actively involved in implementing game-based learning?
- Can existing reporting methods to track results of game-based learning implementations, or do new analytics need to be created to measure success? What will successful implementation look like?

Learning analytics

Benefits

- Learning analytics could be used to improve student retention and support at-risk students by tailoring courses towards the pedagogic needs of students (Johnson et al., 2013).
- Learning analysis tools could also provide faster assessment and feedback for students, and be used for evaluating new pedagogical techniques, allowing lecturers, departments and institutions to focus resources more effectively.

Considerations

- Student data may not come in a format which is easily analysed with data from other sources
    - The granularity of the information can also be variable, and therefore data standardisation and pre-processing would have to be carried out to convert data into appropriate formats and granularities for effective analysis (Romero & Ventura, 2013). This could be a time-consuming process at best, and may not be possible in a lot of cases.
- Learning analytics, academic analytics and educational data mining are also emerging fields, with few tried and tested analytical methods and tools (Romero & Ventura, 2013). Practitioners in these fields require specialist expertise and knowledge of the data source and the institutional context it's situated in to be able to conducted effective analysis.

- It is unclear whether learning analytics can provide an accurate measure of students' learning and engagement. By focusing on the collection of certain types of data, learning analytics may run the risk of using student data in the same simplistic way as media marketing firms, while not fully considering the human interactions involved in students' learning (Richards, 2011).
- Misinterpretation or misuse of data could have consequences, not just for students, but also for staff, whose teaching, funding, and employability may be affected
    - If misused, analytics may lead to privacy and ethical issues, such as conflicts with trade unions, disproportionate levels of workload and discrimination of certain students and staff based institutional politics.

Introduction

Difficult economic times and future uncertainty means the higher education sector in the UK faces challenges of increasing demand for higher education, from both domestic (Burns, 2013) and international sources (Lawton et al., 2013), as well as decreased sources of funding to provide that education. Rapid advances and evolution in the field of education technology promise to revolutionise higher education as we know it, with some even predicting that the next few years will herald the "end of the university as we know it" (Harden, 2013).

Despite this, analysis by Goldman Sachs has shown that investment in education technology has gone from $204 million in 2008 to almost $900 million in 2012 (Mehlenbacher, 2013), showing that institutions are increasingly considering solutions based on education technology to bridge the gap between student demand and resource supply. Indeed, a convergence of economic, social and technological factors, such increasing global demand for higher education, changing learner demographics and increased access to mobile technology and social media, seem to be driving higher education towards a more open, technology-focused model, to address the needs of this diverse, globally-based student body (Yuan & Powell, 2013).

Trends in education technology in higher education can range from mobile devices allowing students to take courses in virtual spaces, to using analytics and open education resources (OERs) to personalise teaching.

In this review, the findings of recent academic reviews, as well as opinions from media articles and blog posts from commentators in the field on the future of higher education will be considered to identify and evaluate common trends in education technology affecting higher education. This paper will consider how these trends are likely to, or are already, affecting course provision at the London School of Economics and Political Science.

Methodology

Horizon scanning techniques were used to identify the key themes explored in this report. Specifically, academic journal articles were found using Google Scholar, The British and Australian Education Indexes, and "Summon" resource retrieval software used by the London School of Economics and Political Science Library. Media articles and blogs for this report were sourced primarily using Twitter by searching through the following topics:

#MOOCs

#BYOD

#Digilit

#educationtechnology

#HigherEd

#Gamification

MOOCs

Arguably, the technology with the most potential to disrupt current models of higher education (HE) provision is Massive Online Open Courses (MOOCs). Sharples et al. (2012) define MOOCs as *"open-access online courses that provide no constraints on class size"*. MOOCs were pioneered by George Siemens through the University of Manitoba's course on Connectivism and Connected Knowledge 2008 (Stewart, 2013). Although MOOCs can vary in many respects, from content to number of students to types of expected participation, MOOCs can generally be categorised in one of two ways, the first kind of which to emerge was connectivist MOOCs (cMOOCs). cMOOCs emphasise connected, collaborative learning based on like-minded individuals free from institutional constraints (Yuan & Powell, 2013). cMOOCs promote peer learning based on the connectivist theory of learning, which emphasises how skills emerge through a combination of experience, learning and networking. MOOCs are often run on open source learning platforms, and may be led by academics as part of a university course.

However, MOOCs really started gaining attention in 2011 when Stanford University's Artificial Intelligence MOOC attracted 160,000 subscribers from every country except North Korea (Lawton & Katsmitros, 2012). Content-based MOOCs (xMOOCs) like the Stanford MOOC follow the pedagogic principles of higher education institutions, and are dominated by linear instructional methods, quizzes and tutorial videos on proprietary specialist software. Private course providers in conjunction with higher education institutions also produce MOOCs, both free and for-profit. Examples include Coursera and Udacity in the US, and Futurelearn in the UK (Lawton & Katsmitros, 2012; Yuan & Powell, 2013).

Predictions on the impact of MOOCs on HE provision range from the benign, such as MOOCs promoting innovation and experimentation in HE teaching, to catastrophic, with universities and Further Education (FE) having to adopt, or having to face *"…a chaotic rout of the sector"* (Haggard et al., 2013).

However, in a related article in Times Higher Education, Haggard (2013) notes that, once one looks past the hype and expectation surrounding MOOCs, MOOCs generally follow a rigid, linear format, and were only really available to *"…learners with excellent online social skills"*. Haggard sees MOOCs evolving to become *"…more diverse, more pragmatic and hard to distinguish from the core activities of the incumbent players – publishers and universities."*

MOOC audiences and outreach

MOOCs have caused excitement and concern throughout the higher education sector, as they offer universities a chance to widen the appeal of, and access to higher education. As demand for university level education is predicted to increase (Gibney, 2013), MOOCs offer potential access to high-quality course content from leading research centres and Western universities, to a vast audience which previously would not have had access to it, such as learners in developing countries (Hodari, 2013). As of March 10 2013, courses by 91 institutions were featured by Coursera, Futurelearn and EdX, with a growing demand worldwide from both students and institutions (Liyanagunawardena, Williams, & Adams, 2013).

However, Lawton et al., (2013) predict that student mobility will increase 7.1% per year, but enrolments from international students will decrease to 1.4% annually by 2020 due to improving higher education provision in home countries and tightening border controls in developed countries. Transnational Education (TNE) would rise to meet the increasing demand for higher education in countries with growing youth populations, such as India and South Korea. Universities have embraced TNE in a number of ways, including by opening overseas branches, and forming franchise partnerships in host countries. However, a key aspect of TNE includes offering overseas students the chance to take courses through paid-for MOOCs.

Some commentators predict that MOOCs could become a very effective recruitment tool for new students on to traditional courses. The University of London's International Programme claims to have recruited around 45 fee-paying students, mainly undergraduates, after introducing four online courses through Coursera in 2013, generating an estimated return of £200,000 (Parr, 2013).

However, recent studies question the claim that MOOCs can open up university level education to wider audiences. Figure 1 shows that the majority (63.4%) of students taking MOOCs on Coursera are based in Europe or North America, and Trucano, (2013) argues that MOOCs have yet to take off in educational policy circles in developing countries.

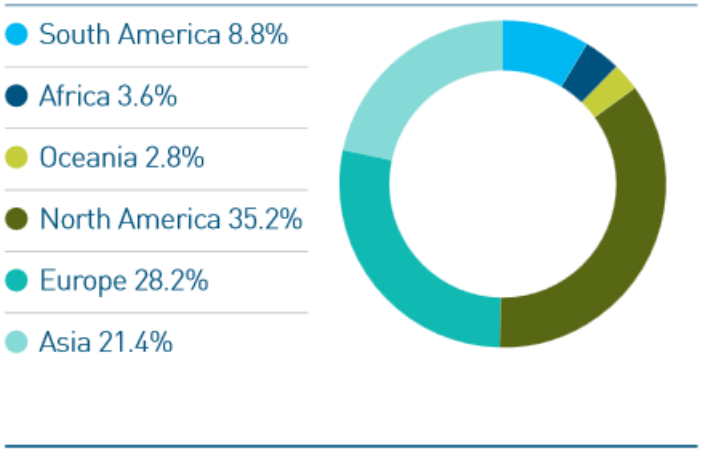

Figure 1: Coursera data on location of learners (Mehlenbacher, 2013)

In addition, Christensen et al., (2013) surveyed around 35,000 MOOC participants, and found that 80% of MOOC students were already university graduates, and 44% of students had postgraduate qualifications. Furthermore, the survey found a more stark disparity between graduates and non-graduates in developing countries such as Russia, India, China, South Africa and Brazil, where 80% of MOOC students came from the wealthiest six percent of the population.

Liyanagunawardena et al., (2013) found that a greater number of Scandinavians relative to their population participated in MOOCs compared to Asian and African participants, proposing that ready access to digital technologies in these countries encourages participation in MOOCs, whilst the lack of such equipment hinders it in less developed countries. Indeed, Liyanagunawardena et al., (2013) also identified accessibility to electricity, 'good' connection to the internet, linguistic barriers and low levels of digital literacy as major hindrances to involving many potential MOOC students worldwide.

Mehlenbacher (2013) found that MOOC students are generally more advanced learners (see Figure 2), however, he argues that these students are more suited to MOOCs, as they are already possess the necessary skills to approach course content, and require little support to navigate course content.

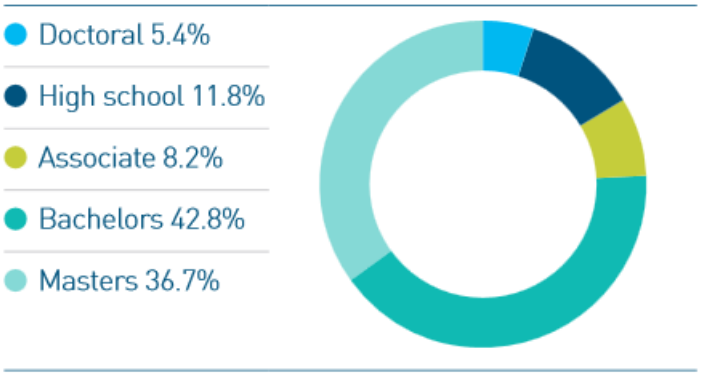

Figure 2: Coursera survey data of prior education levels, January 2013 (Mehlenbacher, 2013)

Learner motivations

Haggard et al., (2013) reviewed the motivations behind why students took the University of Edinburgh's flagship MOOC (see figure 3). 45,000 students were surveyed on entry to the course, and the 15,000 surveyed at the end of the course. The survey found that students were more interested in 'window-shopping' what the course had to offer than advancing their career or seeking certification. The survey also found dramatic declines in student participation after week 1.

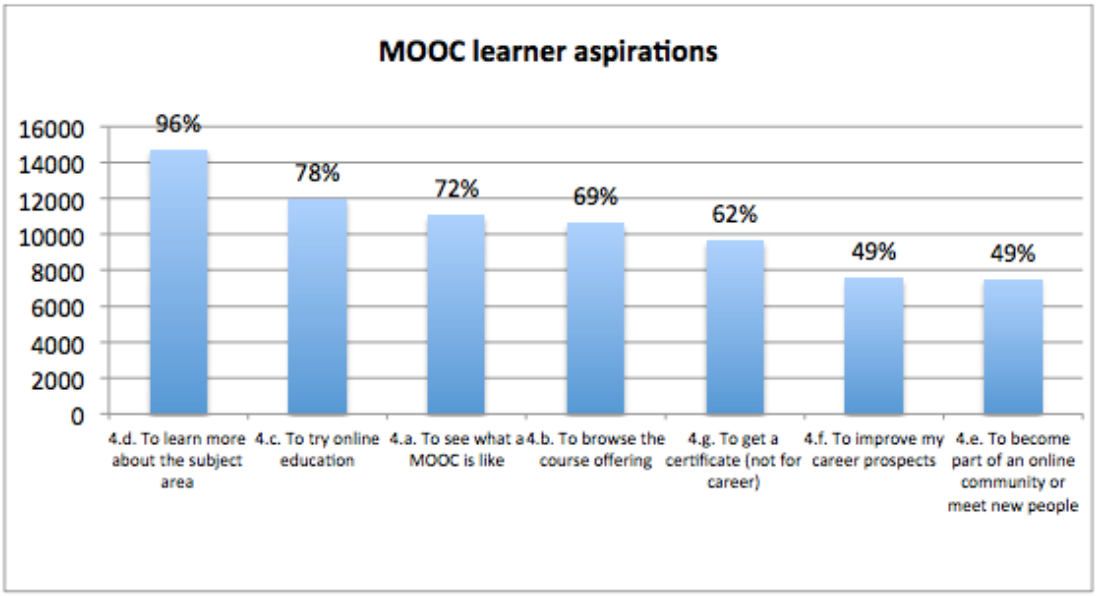

Figure 9 - Combined exit survey responses to Q4 'What did you hope to get out of the course and did it meet your expectations?' – calculated as a sum of *exceeded expectations*, *met expectations*, and *fell below expectations* responses – with percentage shown of total exit survey respondents

Figure 3: The aspirations of learners on the University of Edinburgh's flagship MOOCs (Haggard et al., 2013)

Kizilcec, Piech, & Schneider (2013) suggest that viewing MOOCs in terms of course completion may be a simplistic and monolithic way of viewing how learners use MOOCs. They investigated the ways learners engaged with MOOCs, and categorised learners in to four groups:

1. Auditing
    - learners who complete the majority of the assessments offered in the class
2. Completing
    - learners who do assessments infrequently (if at all) and engage instead by watching video lectures
3. Disengaging
    - learners who do assessments at the beginning of the course but then have a marked decrease in engagement, generally in the first third of the class
4. Sampling
    - learners who enter and exit the course quickly, watching a minimal number of videos at some point during the course

Furthermore, Kizilcec et al. (2013) posited that the distribution of each type of learner depends on the difficulty of the course, and the amount of interactive, engaging activities the MOOC offers. Indeed Balch (2013) found that 93.4% of non-completing students on a computer trading MOOC found the course useful, despite not completing it, indicating that students may not be considering incompletion of the course as lack of satisfaction with the course content.

Student retention and course completion

The concept of providing online course instruction is not a new one, and there are many examples of previous incarnations of MOOCs falling by the wayside, such as Fathom, UKeU and AllLearn (Lawton & Katsmitros, 2012) mainly because of low student retention and inability to raise enough revenue from online instruction. While the average Coursera course in 2012 had between 40,000 and 60,000 students enrolled, only 5% of students were deemed to have completed enough of the course to earn a credential signifying completion of the course (Koller, Ng, Do, & Chen, 2013). Analysis of student retention on 27 MOOCs have shown that the average MOOC attracted 50,000 students, but managed to retain only 7.5% of students (Colman, 2013).

Koutropoulos et al. (2012) suggest that information overload caused by a combination of large amounts of information found on MOOCs, coupled with discussion threads and forums which are updated 24 hours a day by students from around the world and variable levels of students' ability to participate due to other commitments may be a reason for the low levels of course completion on MOOCs.

Simply providing a MOOC does not guarantee an audience. A pilot MOOC programme run at San Jose State university in the USA was put on hold following disappointing retention rates (Van der Mey, 2013), and a high-profile, heavily discounted, *for-credit* MOOC on Computer Science at Colorado State University-Global Campus did not get a single student to sign up (Kolowich, 2013a).

MOOCs as a "laboratory for innovation"

MOOCs use rich media content such as videos, images and graphics to allow students to interact with course materials, and interaction with tutors and each other is facilitated via forums, e-mail and social media. This has led pro-MOOC commentators such as Sharples et al. (2013) to claim that MOOCs are a *"laboratory"* for innovation in higher education, and a sign that the sector is harnessing the transformative potential of technology much in the same way as banking and the music industry.

However, it should be noted that these technologies existed before MOOCs, and media-based course delivery over the internet has been used by distance learning providers such as the Open University for decades (Bates, 2012). Indeed, comparing the effect that companies like Napster had on the music industry to the effect MOOCs could have on the universities threatens to divert focus away from the pedagogy that is used in universities, and could potentially be used in MOOCs, towards a focus on course content an issue based on the copyright and ownership of content.

Earlier forms of MOOCs promised to revolutionise how universities provide course content by promoting connectivism and allowing globally-based students to create networks, reflect on their learning and share ideas (Conole, 2013). The model of MOOC content delivery that is adopted by most institutions, however, are teacher-centred, content-based MOOCs which provide course instruction in a linear format, reminiscent of lecture-based instruction in most universities. Bates, (2012) argues that the pedagogy used by MOOC providers, such as Coursera, as based on *"…a very old and outdated behaviourist pedagogy, relying primarily on information transmission, computer marked assignments and peer assessment"*, and is not suitable for teaching higher-level critical enquiry skills.

Credentials and "Unbundling" of courses

As MOOCs open up course materials to a wider range of students, students are increasingly able to pick and choose the types of MOOCs they would like to take, the institutions from where they can get these skills, and how far they engage with those courses. This level of flexibility allows students the potential to tailor their own learning towards career and personal aspirations, and create unique portfolios to meet the demands of an ever changing job market. This phenomenon is predicted to have an impact on universities, libraries and other academic institutions, as traditional courses with fixed curricula and pre-defined course options become increasingly "unbundled" as students engage in online courses (Barber, Donnelly, & Rizvi, 2013; Lawton & Katsmitros, 2012). In response, Lawton et al., (2013) predict that undergraduate programmes will become more flexible as more and more universities offer online courses by 2020, many with recognised credentials.

However, as employers demand graduates with skills and credentials specific to the needs of certain industries and increasing the increasing cost of a university degree put a strain on student funding (Barber et al., 2013), MOOCs and their providers may de-link universities from their traditional role as providers of recognised qualifications, and offer an alternative sources of recognised qualifications and credentials to students for a fraction of the cost of a university education.

Indeed, a number of online models exist to provide varying levels of credentials for MOOC students. Udacity, for example, has partnered with Pearson VUE, a globally recognised provider of examination services. For a fee, students can now take examinations for Udacity MOOCs at Pearson centres (of which there are 4000 in over 170 countries) and receive credentials and even job placements (Udacity, 2012). Companies like Straighterline de-link course provision with accreditation, offering online courses for $99 per month with 30 partner colleges (Lawton & Katsmitros, 2012). Degreed.com is another example of a service which offers to aggregate the achievements from the various MOOCs taken by students, providing a regularly expanding and updated set of credentials for employers to view (Barber, Donnelly, & Rizvi, 2013). Such providers

may also be expanding their services by offering to advertise students' directly to potential employers with whom they are partnered (Lawton & Katsmitros, 2012).

However, most employers still value traditional university degrees. Half of recruiters are reluctant to accept MOOCs as substitutes for full university degrees, and 70% of respondents reported that an online degree offered the same opportunities as a campus-based university course, according to a survey by CarringtonCrisp, a consultancy (Bradshaw, 2013).

Assessment

Most MOOCs rely on automated marking of multiple choice questionnaires (MCQs), or peer-assessment to manage assessment for the large numbers of students subscribing to the course, both of which are designed to provide assessment for the thousands of students who take MOOCs, but suffer from serious flaws.

MCQs are an easy and popular way of assessing students, and can provide them with instant feedback and easily observable learning targets. However, Jacobs, (2013) found that it was quite easy to find answers for MOOCs by simply searching for them on a search engine. Therefore, there remains concern about how these assessment techniques can be incorporated reliably and accurately.

Peer assessment could be a good way for students to review their own learning, foster collaboration between students from different backgrounds, and even scale-up participation on MOOCs. O'Toole, (2013) argues that peer assessment could be the common ground to bridge assessment for cMOOCs and xMOOCs, and allowing students to participate in assessment could be a form of *action learning pedagogy,* where students improve their perspective on the course, and their assessments skills. However Sadler & Good, (2013) found that peer assessment may not be as useful as predicted, as they found no evidence of improved learning as a result of being a peer assessor, although Sadler & Good, (2013) did find significant improvements in the results for students engaging in self-assessment. The current models of assessment on MOOCs threaten to trivialise the content of their contents, and assessment, particularly peer assessment, requires significant innovation. However, O'Toole, (2013) suggests pedagogy should be the focusing point for peer assessment, and argues that constructionist, workshop-based pedagogy could be a good way of improving the quality of peer assessment. However the ease and ubiquity of using automated marking may make it less attractive to adopt such peer assessment techniques.

Disruptive Innovation

Disruptive innovations offer services or products which go against market expectations (Yuan & Powell, 2013). These innovations often create entirely new markets by lowering prices or aiming products and services at new customers or the needs of existing customers (C. M. Christensen, 2003). In the case of Higher Education, MOOC technology offers flexibility and affordability for the otherwise complex and expensive process of providing higher education, and MOOCs could be viewed as a disruptive innovation on these terms. Fifteen thousand articles were published on the disruptive potential of MOOCs in 2013 (Deloitte, 2013).

However, the predicted 'revolution' in higher education MOOCs were supposed to herald seems to not have occurred. Deloitte's, (2013) technology and media trends report for 2014 predicts that MOOCs will only represent 0.2% of all completed tertiary level, and therefore will only have a minimal disruptive impact on the sector. Instead, MOOCs have been embraced by some of the world's leading universities as a way of promoting their existing course offerings, and the MOOC model of incorporating rich media with open educational resources has inspired some elite universities to produce online courses for specific needs. For example, the Harvard Kennedy School produced one of the first SPOCs (Small Private Online Courses) which restrict the numbers of students who can enrol on to the course by only allowing students who pass the entry criteria or assignment, allowing institutions to better manage the types of students their courses attract (Coughlan, 2013).

Impact on staff

Instead of leading to the "democratization" of higher education that MOOCs are thought to herald, Petriglieri (2013) argues that MOOCs would instead lead to "colonialism" by elite institutions, with MOOCs being *"…used as a cost-cutting measure in already depleted academic institutions and become another weapon against battered faculty bodies. They may worsen rather than eliminate inequality by providing credentials empty of the meaning and connections that make credentials valuable"*.

Petriglieri's views echo that of other academics, who also express concern about the impact MOOCs could have on pedagogy, and their roles in higher education. Jonathon Rees (2013), a professor of History at Colorado State University-Pueblo, argues that MOOCs could simply serve to promote the activities of a few "super-professors" at prestigious "big-name" universities, providing an excuse for institutions to reduce staff numbers and cut staff wages.

Considerations and Implications

MOOCs seem to be following a similar trend to most new technologies, typified by the Gartner Hype trend (figure 5), which charts how expectations of new technologies evolve over time (Kemp, 2013). From recent reports and articles, it could be argued that the excitement generated by the potential of MOOCs is being replaced by disillusionment caused by high student drop-out rates, concerns on their impact on smaller institutions and the entry of private course providers such as Udacity and Coursera.

Figure 5: The Gartner Hype trend charts how expectations of new technologies evolve over time (Kemp, 2013).

MOOCs are unlikely to be the disruptive force that it was initially hyped to be. Despite increases in tuition fees and the option of receiving free, online education via MOOCs, a record number of students enrolled on to courses at UK universities in 2013, 9% up from numbers in 2012 (Burns, 2013). This clearly indicates that, while there is a demand for cheaper, more accessible formats of higher education, students are still attracted by the opportunities to gain qualifications, experiences and lifelong connections that one gets by taking traditional, taught courses at a University, and MOOCs are unlikely to become a replacement for such courses.

At a basic level, MOOCs offer flexibility to student and reproducibility for courses which remain unchanged year on year, and could be used to promote the quality of teaching and the values of LSE to a wider audience, particularly to prospective postgraduate, international and corporate audiences. For example, taster MOOCs on topics on pertinent topics, such as geopolitics or the state of financial institutions for example, could promote the quality of teaching, the use of innovative pedagogies, expert analysis and the Fabian values of LSE. Courses could also be tailored towards TNE efforts by producing MOOCs in languages and for topics affecting countries with large numbers of potential students, such as India, South Korea, Brazil and the Philippines.

MOOCs may even generate revenue through front-end services for students, such as offering credentials, career guidance and tutoring. The data generated on, and by students participating in MOOCs could also be used as a revenue source through analytics, consultancy and targeted advertising. Finally, tailored online courses, such as SPOCs, could also feature as part of existing corporate programmes, such as MBA programmes, allowing greater flexibility for these students, as well as inculcating vital digital literacy skills.

However, MOOCs require significant investment in time and resources of academics and support staff. Institutions typically have to invest between $15,000 and $50,000 in to producing a MOOC (Colman, 2013), including around 100 hours of production time and 8-10 hours a week of academic time for teaching (Kolowich, 2013b). Departments should also seriously consider the benefits of providing free at the point of use courses and the impact producing and maintaining that MOOC will have on the abilities and capacities of academic staff before producing one.

Producing a MOOC also does not guarantee that learners will sign up, be fully engaged, or learn anything useful. Departments and academics considering producing MOOCs must acknowledge that the majority of students joining MOOCs may be attracted, or indeed constrained, by factors such as curiosity towards the topic, existing knowledge and qualifications, the reputation of the institute and the time they can commit to the course, rather than an implicit desire for recognised qualifications or career motivations. Therefore, if MOOCs must are to be seriously considered as a way of teaching core concepts, they must have an emphasis on pedagogy, interactivity, innovation and meaningful assessment and credentialing.

Universities UK recommend that institutions should consider the following questions when producing MOOCs (Pg.3, Mehlenbacher, 2013):

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?

BYOD and Cloud Computing

BYOD

"Bring Your Own Device" (BYOD) refers to the practise of students using their own computing devices in classrooms. Devices have traditionally included laptops, but increasingly feature smartphones and tablets, all of which offer a high degree of mobility and flexibility.

Mobile computing - Smartphones and tablets

As mobile phones have evolved to include colour, high definition screens, cameras and internet connectivity over time, there is no single accepted definition as to what make some phones 'smart' and others 'dumb' (Yu, 2012). Litchfield, (2010) proposes that a smartphone could be defined as a device which *"…runs an open (to new apps) operating system and is permanently connected to the Internet".*

Yu, (2012) observed three major ways in which smartphones were being used in higher education:

1. Using in-built web browsers to access materials online
2. Using applications to access and interact with course content
3. Using Quick Response (QR) codes, scanners and augmented reality (although QR codes and augmented reality have failed to make an impact in higher education)

Other uses included recording lectures and seminars, participating in in-class polls, logging data, taking notes and scanning documents.

Tablets, such as the Apple iPad, Amazon's Kindle, Google Nexus, Samsung Galaxy Tab and Windows Surface, offer students and lecturers a portable, visually compelling tool which expand the intuitiveness, connectivity and mobility of smartphones through a larger screen and processing power. According to Johnson et al., (2013), tablets *"…have gained traction in education because users can seamlessly load sets of apps and content of their choosing, making the tablet itself a portable personalized learning environment".*

Student ownership and use of mobile devices

Grussendorf, (2013) conducted a survey of 1,020 students, on student ownership and use of mobile devices at LSE by found that 97% of students reported owning a laptop, and more than a third reported owning a tablet. Only 1% of respondents reported that they did not own a mobile phone, and only 8% had a phone without internet connectivity. See figure 6 for a breakdown of device ownership among LSE students.

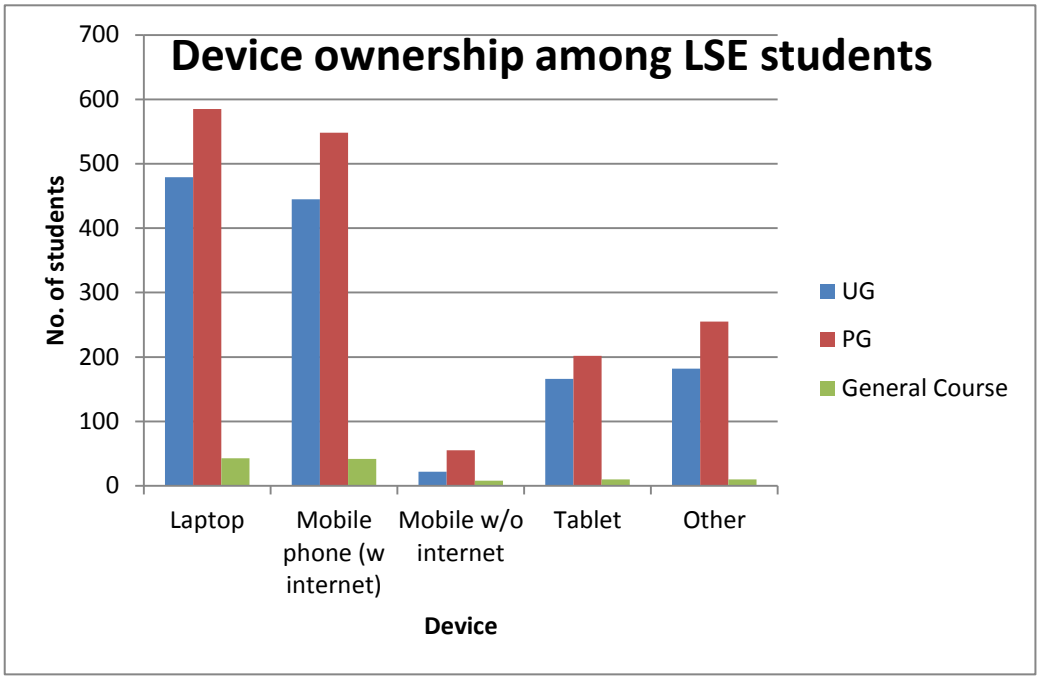

Figure 6: Device ownership among LSE students, *n=1050* (Grussendorf, 2013)

When it came to using their devices in class, half of all participants reported bringing their laptops in to campus every day and two thirds agreed to use their devices in classrooms for learning activities (see figure 7). Students also reported using devices depending on the task they needed to achieve. Laptops were the preferred device for most aspects of learning, including accessing course materials, note-taking, essay writing and communication, while mobile phones were used mainly for communication, organisation, and tablets were used to access course materials and readings (Grussendorf, 2013).

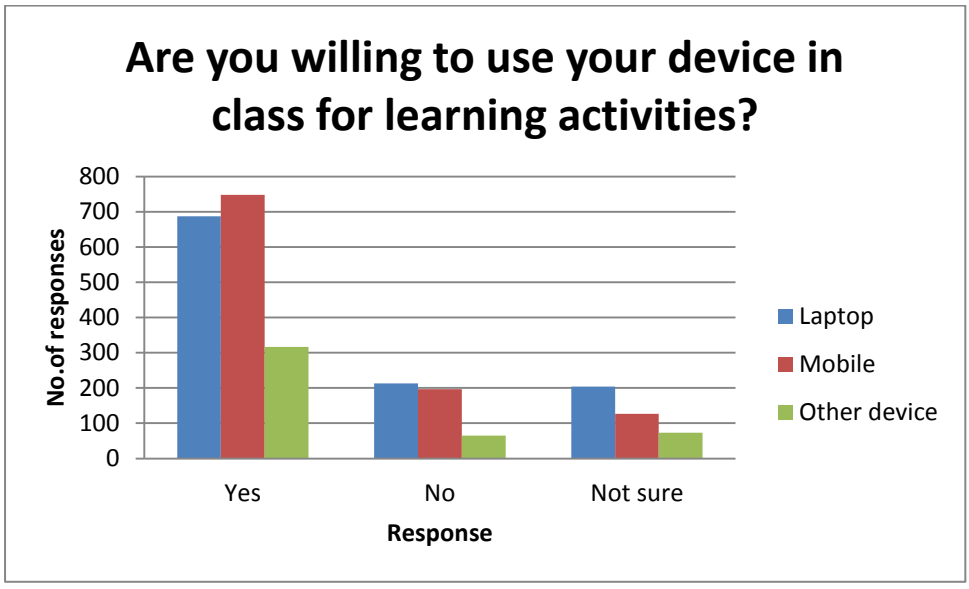

Figure 7: Willingness to use devices for class activities (Grussendorf, 2013)

Educational apps and software

Some of the educational apps used for academic purposes included Khan Academy, Flash Cards, iTunesU. Students also used Dictionary apps and Wikipanion for referencing, Chrome and Safari browsers for browsing information and Evernote, Dropbox, Pages and Keynote for productivity (Chen & Denoyelles, 2013). However the most popular app categories used by students on smart devices were for social networking, accessing music and gaming, showing that students may need to be made more aware of the educational potential of their devices. Indeed, both students and lecturers can be ambiguous about how to access information effectively (Armstrong et al, 2005), and the selective and contextual use of digital technologies, often at a basic level, means students do not transfer the required digital literacy skills to use their devices for educational purposes (Pilerot, 2006). Luo (2010) even found that some students, particularly frequent users of social media, viewed social networking tools as "toys", and were not interested in using educationally useful social tools, such Delicious.

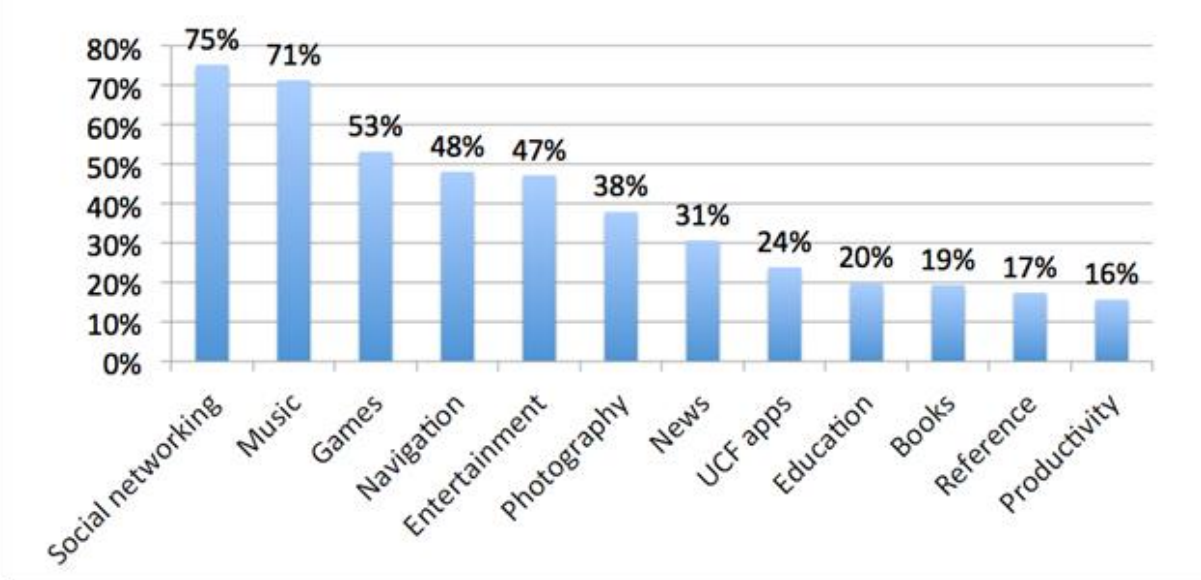

Figure 8: The most popular app categories rated by students (*N=933*) (Chen & Denoyelles, 2013)

M-learning

Tablets and smartphones overcome the size, weight and mobility of PCs and laptops, and allow teaching to become more learner-centric. High definition screens, adjustable magnification, internal storage with the ability to hold thousands of books, magazines and articles, ability to instantly share materials on via conventional and social media and the ability to play embedded videos and follow links make tablets and e-readers an engaging alternative to the traditional textbook and journal. Students now have the ability to create their own, customisable learning environment using collaborative applications such as Dropbox, Delicious and Cheddar on these devices (Johnson et al., 2013). The ability to have a customisable learning environment could be especially useful for distance learners, off-campus students and part-time students juggling work and care commitments.

These devices are also widely being used to help students to navigate campus life through dedicated university apps, connected to the internet and social media. These allow students to access news, course materials and university information. Some institutions have already started handing out tablets with pre-loaded information to students as a learning tool. Students studying Social Journalism in a Mass Communications course at Virginia Commonwealth University in the USA were given iPads to create multimedia news stories, which were submitted for grading and uploaded to a local news website (Porter, 2012). Integrating tablets and other devices in this way is an excellent way of instilling, not just skills necessary for the course, but also digital literacy skills which are important for lifelong learning and development.

Pedagogically, M-learning could provide lecturers the opportunity to blur the lines between formal and informal learning. Lecturers could encourage students to use their devices and the collaborative tools they support (such as social media) to work together on assignments both in physical and virtual learning spaces (Lai, Khaddage, & Knezek, 2013). Mobile applications could increase interactivity between students and their lecturers through in-class tasks, allow students to leave the classroom and learn in places which provide more contextual meaning to their learning, and ultimately foster a more student-centred learning approach (Holzinger, Nischelwitzer, & Meisenberger, 2005).

Cloud computing

With BYOD and increasing need for data intensive computer-based systems for learning in modern universities, comes an increasing demand for large-scale, secure methods to store the data used and generated by these devices, and cloud storage and computing may be able to provide a solution to this issue.

Like smartphones, there is no widely accepted definition of what constitutes cloud computing. Fundamentally, cloud computing is a concept involving large numbers of computers connected through a real-time network (Carroll, Kotzé, & Van der Merwe, 2012). However, a commonly used definition is that cloud computing refers to clusters of distributed computers (largely vast data centres and sever farms) which provide on-demand resources and services over a networked medium such as the internet (Sultan, 2010). Cloud computing offers a range of features such as:

- Virtualization: The Cloud can be considered as a virtual resource pool. Resources can be accessed via a browser, and data need not be stored locally.
- Reliability, usability and extensibility: The Cloud can provide a safe mode to store a user's data, without having to deal with software updates, patching, data loss or virus attacks.
- Scale: To allow mass storage and supercomputer levels of processing capacity, the Cloud network often contains thousands of interconnected PCs and servers.
- Autonomy: Cloud systems are usually autonomous systems, where software and data inside can be configured and consolidated according to a user's needs (Kottari, Kamath, Saldanha, & Mohan, 2013).

Benefits

BYOD policies could also push for more innovative pedagogical techniques, as well as offering a solution to the institutional needs to constantly provide up-to-date IT infrastructures to cope with the needs of modern universities (Evans & Matthew, 2013).

Cloud computing also circumvents the need to constantly update institutional software, which can be expensive and cause disruptions to campus activities. Using a trusted third party provider could be a good way to maximise the utility of in-house resources for research and teaching, while maintaining the security of sensitive materials (Lakshminarayanan, Kumar, & Raju, 2013). The LSE is already testing Microsoft Sharepoint services as an official cloud-based service for staff, and Google Drive and Dropbox are already extensively used by students and staff alike for study and extra-curricular purposes.

Other benefits of using cloud computing included:

- Lower equipment costs as fewer desktop units are required, particularly if coupled with a BYOD policy
- Subsequent reduction in energy costs from reduction in on-campus equipment
- Improving learner retention amongst younger learners
- Continuation of classes through disruptions such as bad weather
- More efficient use of classrooms, by allowing
- Collaborative work through Virtual Learning Environments (VLEs) and forums (Lennon, 2012).

Considerations for deploying BYOD and Cloud Computing

Lennon (2012) described the introduction of cloud computing and BYOD in an Irish Institute of Technology looking to address the needs of distance learners and commuting students. Lennon, (2012) suggests that institutions must consider the specific needs of the distinct groups of data users at universities, namely students, administrative staff and teaching staff. Data security is a particular concern affecting all three groups in different ways. While administrative staff may contend with important, yet low level issues on data security, research and teaching staff may face greater pressure to protect sensitive teaching materials and research. Students' devices may not be secure, as Lennon (2012) found that most students did not regularly update their virus protection software.

Students may face problems regarding the affordability of some devices and materials, as well costs to maintain or replace damaged equipment. Many academic journals and articles are as yet inaccessible to students, due to varying levels of journal access for university libraries and paywalls. Students will also bring devices of varying capacities, variable connectivity to the internet and using various operating systems, which may not support the materials that lecturers want to their students to use. Grussendorf, (2013) found that availability of power points and WiFi connectivity were issues raised several times by LSE students.

Students may also be resistant to using their own devices for privacy reasons, but also because of an expectation that institutions should provide computing equipment for their studies as part of their

course, and therefore there will still be a requirement to provide students with IT equipment into the near future (Giacomini, 2010).

Conclusion

BYOD and Cloud Computing offer a ready solution to the every-changing IT needs of modern universities, and students are often willing to use their own devices to aid their studies, for reasons including the mobility mobile devices offer, the flexibility to exploit learning spaces outside of lecture theatres and classrooms, and the convenience of limiting the number of platforms they need to use (Chen & Denoyelles, 2013; Grussendorf, 2013).

Not all students may be thrilled by the prospect of universities expecting students to provide their own IT devices (Giacomini, 2010), or use them in an educational context (Luo, 2010). There are also stark differences in the competency of users when using BYOD and Cloud services, and additional training will almost certainly be required to ensure users do not compromise data security and optimise the use of their devices. The digital literacy of students may also be an issue. Students are often unaware of the literacies and skills they need to use devices effectively for learning, and may even be over-confident of their skills when using digital information sources (Gross & Latham, 2009). As students generally only have selective and basic experiences of using email, word processing tools and social media, they may not necessarily have the sufficient IT skills to navigate academic life (Pilerot, 2006).

However, before considering implementing BYOD or Cloud-based solutions, institutions must ensure that the technology supports M-learning, and adds value to the teaching and learning of students. Grussendorf, (2013) found that technology was reported as used in a complementary way to aid teaching and learning by 40% (n=400) of students, but 37% of respondents (n=377) still claimed that their courses used technology in an administrative way.

Therefore institutions considering implementing BYOD-based learning must ensure that:

- Educational materials are cross-compatible and accessible with both learners' devices and learning needs.
- Institutions wishing to promote the idea of students and staff bringing their own devices will need to consider providing appropriate learning spaces which cater for student and staff needs, including easily accessible plug-points to charge their devices, software licenses for device-friendly specialist software, appropriate internet connectivity and security, both in terms of software and physical security.
- Institutions may still have to provide devices for students without the means to provide their own. This may include devices such as fixed terminal computers.

Gamification and Game-based learning

Using games to teach skills and concepts is an ancient concept, and even the use of video games for educational purposes is a concept that has origins in the 1970s (Epper, Derryberry, & Jackson, 2012). Games can be a very rewarding method of instruction for learners and a good way of teaching 'soft skills' such as critical enquiry and resource management, and even to instil a sense of competition amongst students. Games and gamification can be extremely engaging particularly if the game can facilitate a 'flow experience', or a state of complete absorption or engagement in an activity (Kiili, 2005).

However, while video games have been around since the early 1970's, they have only recently been considered as a mainstream form of entertainment. Previously thought of as the preserve of young, 'nerdy' males, gaming is increasingly appealing to a wider audience, with almost 60% of Americans reported playing video games in 2012, 45% of gamers being female, and the average age of gamers being 30 (ESA, 2013).

Gaming has become big business, with consultancy firm Pricewaterhouse Coopers (PwC) predicting that video game sales figures would rise to $82 billion by 2015 (Cross, 2011). With the potential to deeply engage students with course content, the majority of modern undergraduate students being familiar with game formats having grown up with video games, and more mature students engaging with gaming in some form, it is not surprising that interest in using video game elements for education is resurfacing as a way to engage students.

Gamification

According *to* Deterding, Sicart, Nacke, O'Hara, & Dixon, (2011), gamification is *"...an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience and user engagement"*. It involves combining instructional design concepts with game dynamics. An article in the Scientific American predicted that gamification would be one of 10 life changing trends affecting almost every part of our lives, not just education (Pavlus, 2010).

Gamification can be used to monitor the progress of students through a course, for instance by setting course objectives, providing instantaneous or regular feedback, rewarding students through badges and other credentials, monitoring attendance through social media 'check-ins' and/or allowing students to manage all of these aspects through virtual avatars (Lawton et al., 2013).

Game-based learning

Game-based learning differs in gamification in that actual games simulating the concepts being taught are used to transfer skills and knowledge, instead of modifying existing course content or parameters using game elements. These games allow students to explore actual concepts and skills in a more informal environment.

Benefits

It has been argued that computer games can be considered to be complex learning environments requiring instructional support in cognitive activities, such as decision-making (Wouters & van Oostendorp, 2013). An example of this is the game "Peacemaker" by ImpactGames, (2010) , where players can play as either the Israeli Prime Minister, or the Palestinian leader, with the aim of finding

a solution to the Arab-Israeli conflict. Players are provided with a range of options to play the game based on actual policies used in the region, and the course of the game is affected by actions committed by the player, and computer-generated stakeholders based on actual parties involved in the conflict. The challenges of navigating the game can give students a powerful sense of how deep the issue is, and how certain policies and political stances can affect outcomes in the real world.

Other serious games have been explored to teach practical skills, including medical procedures. Knight et al, (2010) evaluated using game-based learning to teach triage and resuscitation skills in a Major Incident Medical Management and Support Course (MIMMS), and concluded that such games offered the potential to enhance learning and performance when compared to traditional educational methods.

In this regard, Pivec, (2007) argues that games-based learning could support a constructivist pedagogy, whilst by allowing students to collaborate, interact in virtual environments (in multiplayer games), manage problems and learn through virtual experiences.

Considerations for implementation

Games-based learning is not a new phenomenon, and the idea of using computers and hypermedia for educational purposes has been around since at least the 1980s (Pivec, 2007). Previous studies have shown variable results regarding the transferability of the skills learned through games (Tobias, Fletcher, & Wind, 2014). Tobias et al., (2014) argue that, to ensure that skills learned from gamification or games-based learning transfer to real-world situations if there is a comparable cognitive overlap. Therefore games which simulate the cognitive and motor skills required in real-world situations are more likely to lead to successful learning outcomes than more abstract games.

Implementing games-based learning may require actually producing the game for the concept in question, as most games are one-off products tailored to specific institutions, which may not be easily adopted in other institutions. Designing games that are accessible to all students, are engaging and lead to positive learner outcomes requires expertise which are often beyond those of the academics interested in using game-based learning.

Therefore producing educational games would probably require external expertise to produce, leading to cost issues (Epper et al., 2012). There is also a chance that some games may be too successful, and may turn in to a distraction for students, or gamification leads to the opposite outcome of trivialising course aspects, such as attendance.

Lecturers considering using gamification and game-based learning need to define the rationale behind using it in the course, and have a clear strategy of implementation. It may be more beneficial to use gamification to teach complex concepts which could benefit from a greater ability to be visualised.

Institutional infrastructure and equipment needs to be able to handle the requirements of the game or gamified content, and faculty and support staff needs to be able and prepared to produce and maintain games and adapt course content accordingly. Epper et al., (2012) suggest that academics and institutions must ask the following questions before implementing game-based learning or

gamification of courses (see figure 9 for how an institution may be able to view a game-based learning environment):

- How does game-based learning align with the overall institutional strategy? Where, specifically, does it produce the greatest effect on achieving primary goals?
- Which university communities or stakeholders on campus have investigated or piloted game-based learning, through which projects? What were their results?
- How to ensure sufficient interest and investment? Which groups on campus are in the best position to become actively involved in implementing game-based learning?
- Can existing reporting methods to track results of game-based learning implementations, or do new analytics need to be created to measure success? What will successful implementation look like?

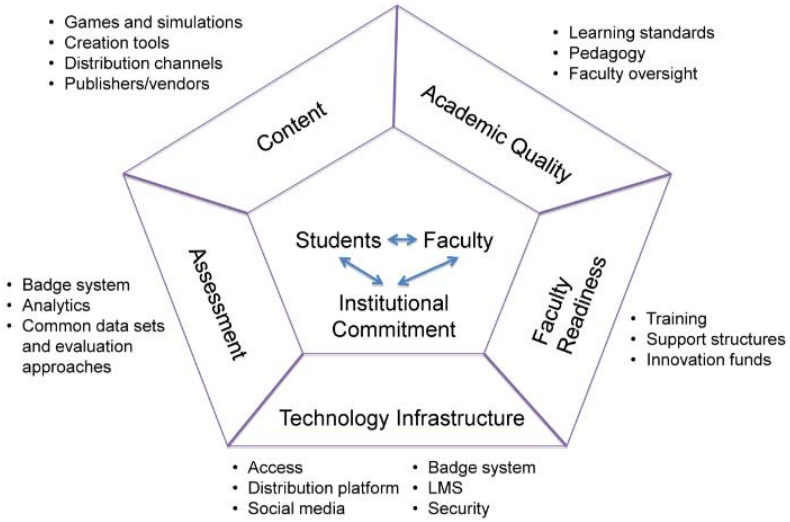

Figure 9: Institutional Perspective of the Game-Based Learning Ecosystem (Epper et al., 2012).

Learning Analytics

Learning Analytics are a relatively new field of research attempting to harness the potential of data to analyse student activities. It is defined as *"…the measurement, collection, analysis, and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs"* (Siemens, 2013). Learning analytics are an attempt to utilise the large amounts of data produced by the various systems used to monitor and improve the progress and wellbeing of students. Since 2010, there has been an effort to disambiguate learning analytics, which is focused towards the needs of students, faculty and departments, from academic analytics, looking at issues at an institutional and governmental level (Ferguson, 2012). Analytics may even provide data to track individual students' progress, and tailor teaching to enhance their

learning (see figure 10.)

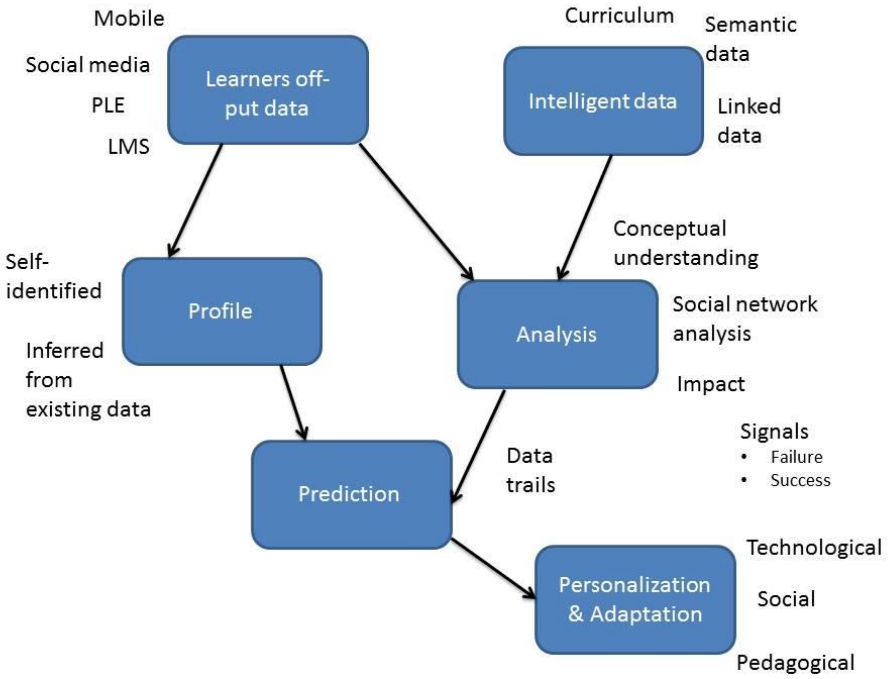

Figure 10: A proposed learning analytics flow-chart, and how it can be used to adapt and personalise student experience (Adapted from Siemens, 2010).

Educational data mining (EDM) is another sub-set of learning analytics concerned with the development of methods for exploring and analysing datasets sourced from educational settings to better understand those settings and student learning (Siemens, 2013). It emerged from the analysis of data logs containing information on student-computer interactions, and tries to answer the question "how can we extract value from these big sets of learning-related data?" (Ferguson, 2012). EDM therefore uses techniques such as classification, social network analysis, relationship and process mining, and Bayesian modelling to predict student performance and outcomes (Romero & Ventura, 2013).

Benefits

Learning analytics could be used to improve student retention and support at-risk students by tailoring courses towards the pedagogic needs of students (Johnson et al., 2013). An example of the integration of learning analytics include Purdue University's Signals project, which identifies at-risk students by incorporating data from student information systems, course management systems and grade books to generate failure risk levels for individual students (Johnson et al., 2013). Learning analysis tools could also provide faster assessment and feedback for students, and be used for evaluating new pedagogical techniques, allowing lecturers, departments and institutions to focus resources more effectively.

Considerations

Whilst student data can be generated from several sources, it may not come in a format which is easily analysed with data from other sources. For example, log data from VLEs would come in a numerical format which may have to be compared to qualitative data, such as feedback comments given to students during assessments. The granularity of the information can also be variable, and

therefore data standardisation and pre-processing would have to be carried out to convert data into appropriate formats and granularities for effective analysis (Romero & Ventura, 2013). This could be a time-consuming process at best, and may not be possible in a lot of cases.

Learning analytics, academic analytics and educational data mining are also emerging fields, with few tried and tested analytical methods and tools (Romero & Ventura, 2013). Practitioners in these fields require specialist expertise and knowledge of the data source and the institutional context it's situated in to be able to conducted effective analysis. These tools and techniques may also be research and institution specific, and finding easily affordable and accessible analysis tools to conduct fast, generic enquiries into student issues may not yet be possible by these means, although may well be in the near future.

Whilst learning analytics may be able to profile courses, classes and individual students in terms of number of hits, clicks, views etc, it is unclear whether learning analytics can provide an accurate measure of students' learning and engagement. By focusing on the collection of certain types of data, learning analytics may run the risk of using student data in the same simplistic way as media marketing firms, while not fully considering the human interactions involved in students' learning. Therefore a thoughtful, contextual interpretation of data is required to identify meaningful trends (Richards, 2011).

Misinterpretation or misuse of data could have consequences, not just for students, but also for staff, whose teaching, funding, and employability may be affected. Richards (2011) argues that analytics may be used to spy into classrooms, leading to privacy and ethical issues, such as conflicts with trade unions, disproportionate levels of workload and discrimination of certain students and staff based institutional politics. Therefore, due care and attention needs to be used when learning analytics data is used.

Conclusion

Difficult economic times have meant that students have had to make increasingly difficult decisions on choosing courses and providers, paying for university fees, moving or commuting to study for courses, and gaining the skills that improve their employability prospects. With almost ubiquitous access to the internet, easily accessible educational resources, and unprecedented levels of flexibility offered by impressive computational ability in mobile devices, students have access to a wider variety of educational sources and providers than ever before, will increasingly be expected to take ownership of their own learning. Students may also be driven towards informal learning via third party providers to gain the skills demanded by employers, putting a greater strain on universities already suffering from financial restraints in the post-recession funding environment. Therefore, there has never been a more important time for universities to evaluate the services and technologies they can provide to students.

The revolution and uprooting of university education that technologies such as MOOCs promised does not seem to be a reality in the near future. This may change as third-party firms provide more sophisticated online courses, BYOD offers students the opportunity to simulate campus life more effectively etc. However, Universities currently stand to benefit from the technological possibilities

of using MOOCs, BYOD, game-based learning and learning analytics, to explore new pedagogies and ways to engage wider audiences and inspire their students. At the heart of any technological adoption should be pedagogic considerations of whether the technology improves learning, student engagement and staff workload.

Bibliography

Armstrong, C., Boden, D., Town, S., Woolley, M., & Webber, S. (2005). CILIP defines Information Literacy for the UK. *Library and Information Update*, *4*, 22–25.

Balch, T. (2013). MOOC Student Demographics (Spring 2013). *The Augmented Trader*. Retrieved November 04, 2013, from http://augmentedtrader.wordpress.com/2013/01/27/mooc-student-demographics/

Barber, M., Donnelly, K., & Rizvi. (2013). *An Avalanche is Coming: Higher education and the revolution ahead*. London, United Kingdom. Retrieved from http://www.ippr.org/images/media/files/publication/2013/04/avalanche-is-coming_Mar2013_10432.pdf

Bates, T. (2012). What's right and what's wrong about Coursera-style MOOCs. *Online Learning and Distance Education Resources*. Retrieved February 25, 2014, from http://www.tonybates.ca/2012/08/05/whats-right-and-whats-wrong-about-coursera-style-moocs/

Bradshaw, D. (2013, August 18). Moocs are treated with suspicion by students and recruiters. *The Financial Times*. London, United Kingdom. Retrieved from http://www.ft.com/cms/s/2/f6f45fc4-0678-11e3-ba04-00144feab7de.html#axzz2jghwXvRN

Burns, J. (2013). Record numbers of students fill university places early. *BBC News*. Retrieved November 11, 2013, from http://www.bbc.co.uk/news/education-23725540

Carroll, M., Kotzé, P., & Van der Merwe, A. (2012). Securing Virtual and Cloud Environments. In I. Ivanov, M. Van Sinderen, & B. Shishkov (Eds.), *Cloud Computing and Services Science, Service Science: Research and Innovations in the Service Economy*. New York City, New York, USA: Springer Science+Business. Retrieved from http://link.springer.com/book/10.1007/978-1-4614-2326-3

Chen, B., & Denoyelles, A. (2013). Exploring Students' Mobile Learning Practices in Higher Education. *Educause Review Online*. Retrieved from http://www.educause.edu/ero/article/exploring-students-mobile-learning-practices-higher-education

Christensen, A. G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). The MOOC Phenomenon: Who Takes Massive Open Online Courses and Why? Philadelphia, Pennsylvania, USA. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2350964

Christensen, C. M. (2003). *The innovator's solution: creating and sustaining successful growth.* Cambridge, Massachusetts: Harvard Business Press.

Colman, D. (2013). The Big Problem for MOOCs Visualized. *Open Culture*. Retrieved November 12, 2013, from http://www.openculture.com/2013/04/the_big_problem_for_moocs_visualized.html

Conole, G. (2013). MOOCs as disruptive technologies: strategies for enhancing the learner experience and quality of MOOCs. *Revista de Educación a Distancia*, *39*, 1–17. Retrieved from http://www.um.es/ead/red/39/conole.pdf

Coughlan, S. (2013). Harvard plans to boldly go with "Spocs." *BBC News*. Retrieved from http://www.bbc.co.uk/news/business-24166247

Cross, T. (2011, December). All the world's a game. *The Economist*. Retrieved from http://www.economist.com/node/21541164

Deloitte. (2013). *Technology, Media & Telecommunications Predictions 2014* (pp. 16–19). Sydney, Australia.

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification: Using game-design elements in non-gaming contexts. In *Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems - CHI EA '11* (p. 2425). New York, New York, USA: ACM Press. doi:10.1145/1979742.1979575

Epper, R., Derryberry, A., & Jackson, S. (2012). Game-Based Learning: Developing an Institutional Strategy (Research Bulletin). Louisville, Kentucky, USA. Retrieved from http://net.educause.edu/ir/library/pdf/ERB1208.pdf

ESA. (2013). *Essential Facts About the Computer and Video Game Industry: Sales, Demographic and Usage Data*. Retrieved from http://www.theesa.com/facts/pdfs/ESA_EF_2013.pdf

Evans, R., & Matthew, A. F. (2013). A new era: personal technology challenges educational technology. In *Proceedings of the 30th Ascilite Conference*. Sydney, Australia: ASCILITE. Retrieved from http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics/

Ferguson, R. (2012). Learning analytics: drivers, developments and challenges. *International Journal of Technology Enhanced Learning*, *4*(5/6), 304. doi:10.1504/IJTEL.2012.051816

Giacomini, C. (2010, September). Imagining All of Campus as a Learning Environment. *Educause Review Online*. Retrieved from http://www.educause.edu/ero/article/imagining-all-campus-learning-environment

Gibney, E. (2013, January). A Different World. *Times Higher Education*. Retrieved from http://www.timeshighereducation.co.uk/features/a-different-world/2001128.article

Gross, M., & Latham, D. (2009). Undergraduate Perceptions of Information Literacy : Defining , Attaining , and Self-Assessing Skills. *College and Research Libraries*, *70*(4), 336–350. Retrieved from http://crl.acrl.org/content/70/4/336.short

Grussendorf, S. (2013). *Device Ownership, "BYOD" & Social Media for Learning*. London, United Kingdom. Retrieved from http://eprints.lse.ac.uk/cgi/search/simple?q=DEVICE+OWNERSHIP%2C+%E2%80%98BYOD%E2%80%99+%26+SOCIAL+MEDIA+FOR+LEARNING&_action_search=Search&_action_search=Search&_order=bytitle&basic_srchtype=ALL&_satisfyall=ALL

Haggard, S. (2013, October 3). The Mooc wave of hype will break on a transformed world. *Times Higher Education*. London, United Kingdom. Retrieved from http://www.timeshighereducation.co.uk/comment/opinion/moocs-from-mania-to-mundanity/2007773.article

Haggard, S., Brown, S., Mills, R., Tait, A., Warburton, S., Lawton, W., … Angulo, T. (2013). The Maturing of the MOOC: Literature Review of Massive Open Online Courses and Other Forms of Online Distance Learning. London, United Kingdom.

Harden, N. (2013). The End of the University as We Know It. *The American Interest*. Retrieved from http://www.the-american-interest.com/article.cfm?piece=1352

Hodari, J. (2013). The Developing World Shouldn't Fear MOOCs. *Slate*. Retrieved February 25, 2014, from http://www.slate.com/articles/technology/future_tense/2013/11/kepler_spire_the_developing_world_should_embrace_moocs.html

Holzinger, a., Nischelwitzer, A., & Meisenberger, M. (2005). Mobile Phones as a Challenge for m-Learning: Examples for Mobile Interactive Learning Objects (MILOs). In *Third IEEE International Conference on Pervasive Computing and Communications Workshops* (pp. 307–311). Ieee. doi:10.1109/PERCOMW.2005.59

ImpactGames. (2010). Peacemaker. *ImpactGames*. Retrieved February 26, 2014, from http://www.peacemakergame.com/

Jacobs, A. . (2013). Two Cheers for Web U. *New York Times*. Retrieved November 08, 2013, from http://www.nytimes.com/2013/04/21/opinion/sunday/grading-the-mooc-university.html?pagewanted=all&_r=0

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). *NMC Horizon Report: 2013 Higher Education Edition*. Austin, Texas.

Kemp, J. (2013). Gartner Hype Cycle. *Wikipedia*. Retrieved February 24, 2013, from http://en.wikipedia.org/wiki/File:Gartner_Hype_Cycle.svg

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The Internet and Higher Education*, *8*(1), 13–24. doi:10.1016/j.iheduc.2004.12.001

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). Deconstructing Disengagement: Analyzing Learner Subpopulations in Massive Open Online Courses Categories and Subject Descriptors. In *Third Conference on Learning Analytics and Knowledge*. Leuven, Belgium: LyticsLab@Stanford. Retrieved from http://lytics.stanford.edu/deconstructing-disengagement/

Knight, J. F., Carley, S., Tregunna, B., Jarvis, S., Smithies, R., de Freitas, S., … Mackway-Jones, K. (2010). Serious gaming technology in major incident triage training: a pragmatic controlled trial. *Resuscitation*, *81*(9), 1175–9. doi:10.1016/j.resuscitation.2010.03.042

Koller, D., Ng, A., Do, C., & Chen, Z. (2013). Retention and Intention in Massive Open Online Courses: In Depth. *Educause Review Online*. Retrieved October 28, 2013, from http://www.educause.edu/ero/article/retention-and-intention-massive-open-online-courses-depth-0

Kolowich, S. (2013a). A University's Offer of Credit for a MOOC Gets no Takers. *The Chronicle of Higher Education*. Retrieved October 29, 2013, from http://chronicle.com/article/A-Universitys-Offer-of-Credit/140131/

Kolowich, S. (2013b). The Professors Who Make the MOOCs. *The Chronicle of Higher Education*. Retrieved November 12, 2013, from https://chronicle.com/article/The-Professors-Behind-the-MOOC/137905/#id=overview

Kottari, V., Kamath, G. V., Saldanha, L. P., & Mohan, C. (2013). A Survey on Mobile Cloud Computing: Concept , Applications and Challenges. *International Journal of Advances and Innovative Research*, *2*(3), 487–492. Retrieved from http://s3.amazonaws.com/academia.edu.documents/31067670/A_Survey_on_Mobile_Cloud_Computing-Concept__Applications_and_Challenges.pdf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1384866004&Signature=GPe0cIp90y62Nc5dbUtmdBCeTIU%3D&response-content-disposition=inline

Koutropoulos, A., Gallagher, M. S., Abajian, S. C., de Waard, I., Hogue, R. J., Keskin, N. O., & Rodriguez, C. O. (2012). Emotive Vocabulary in MOOCs: Context & Participant Retention. *European Journal of Open, Distance and E-Learning*, 1–22. Retrieved from http://files.eric.ed.gov/fulltext/EJ979609.pdf

Lai, K.-W., Khaddage, F., & Knezek, G. (2013). Blending student technology experiences in formal and informal learning. *Journal of Computer Assisted Learning*, *29*(5), 414–425. doi:10.1111/jcal.12030

Lakshminarayanan, R., Kumar, B., & Raju, M. (2013). Cloud Computing Benefits for Educational Institutions. In *Second International Conference of the Omani Society for Educational Technology*. Muscat, Oman: Cornell University Library. Retrieved from http://arxiv.org/ftp/arxiv/papers/1305/1305.2616.pdf

Lawton, W., Ahmed, M., Angulo, T., Axel-Berg, A., Burrows, A., & Katsomitros, A. (2013). *Horizon Scanning: What will Higher Education look like in 2020?* Retrieved from http://www.international.ac.uk/media/2423997/horizonscanningreportfinalprint.pdf

Lawton, W., & Katsmitros, A. (2012). *MOOCs and disruptive innovation: The challenge to HE business models* (Vol. 2011, pp. 1–10). Retrieved from http://www.obhe.ac.uk/documents/view_details?id=929

Lennon, R. G. (2012). Bring your own device (BYOD) with Cloud 4 education. In *Proceedings of the 3rd annual conference on Systems, programming, and applications: software for humanity - SPLASH '12* (p. 171). Indianapolis, Indiana, USA: ACM Press. doi:10.1145/2384716.2384771

Litchfield, S. (2010). Defining the Smartphone - PArt 1. *All About Symbian*. Retrieved November 18, 2013, from http://www.allaboutsymbian.com/features/item/Defining_the_Smartphone.php

Liyanagunawardena, T., Williams, S., & Adams, A. (2013). The impact and reach of MOOCs: a developing countries ' perspective. *eLearning Papers*, *33*. Retrieved from http://centaur.reading.ac.uk/32452/1/In-depth_33_1.pdf

Luo, L. (2010). Web 2.0 Integration in Information Literacy Instruction: An Overview. *The Journal of Academic Librarianship*, *36*(1), 32–40. doi:10.1016/j.acalib.2009.11.004

Mehlenbacher, B. (2013). *Massive open online courses; Higher education's digital moment?* doi:10.1145/2316936.2316953

O'Toole, R. (2013, May). Pedagogical strategies and technologies for peer assessment in Massively Open Online Courses (MOOCs). *University of Warwick Discussion Paper*, 1–14. Retrieved from http://wrap.warwick.ac.uk/54602/7/WRAP_O%27toole_ROToole Peer Assessment in MOOCs %281%29.pdf

Parr, C. (2013). London predicts Mooc recruitment windfall. *Times Higher Education*. Retrieved November 07, 2013, from http://www.timeshighereducation.co.uk/news/london-predicts-mooc-recruitment-windfall/2008809.article#.UnutaMNesYo.twitter

Pavlus, J. (2010). The Game of Life. *Scientific American*. Retrieved November 14, 2013, from http://www.scientificamerican.com/article.cfm?id=world-changing-ideas-dec10

Petriglieri, G. (2013). Let Them Eat MOOCs. *Harvard Business Review Blog Network*. Retrieved October 16, 2013, from http://blogs.hbr.org/2013/10/let-them-eat-moocs/

Pilerot, O. (2006). Information Literacy - An Overview. In A. Martin & D. Madingan (Eds.), *Digital Literacies for Learning* (pp. 80–88). London: Facet Publishing.

Pivec, M. (2007). Editorial: Play and learn: potentials of game-based learning. *British Journal of Educational Technology*, *38*(3), 387–393. doi:10.1111/j.1467-8535.2007.00722.x

Porter, M. (2012). Mass Communications Students use iPads for Social Journalism Class. *Virginia Commonwealth University News*. Retrieved November 19, 2013, from http://www.news.vcu.edu/article/Mass_Communications_students_use_iPads_for_social_journalism

Rees, J. (2013). The MOOC Racket. *Slate*. Retrieved November 04, 2013, from http://www.slate.com/articles/technology/future_tense/2013/07/moocs_could_be_disastrous_for_students_and_professors.html

Richards, G. (2011). Measuring Engagement: Learning Analytics in Online Learning. In *Electronic Kazan 2011*. Kazan, Russia.

Romero, C., & Ventura, S. (2013). Data mining in education. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *3*(1), 12–27. doi:10.1002/widm.1075

Sadler, P. ., & Good, E. (2013). The impact of self- and peer-grading on student learning. In D. G. Glance, M. Forsey, & M. Riley (Eds.), *The Pedagogical Foundations of Massive Open Online Courses* (18(5) ed., pp. 1–11). First Monday. Retrieved from http://firstmonday.org/ojs/index.php/fm/article/view/4350/3673#p6

Sharples, M., McAndrew, P., Weller, M., Ferguson, R., Fitzgerald, E., Hirst, T., & Gaved, M. (2013). *Innovating Pedagogy 2013: Open University Innovations Report 2*. Milton Keynes, United Kingdom. Retrieved from http://www.open.ac.uk/personalpages/mike.sharples/Reports/Innovating_Pedagogy_report_2013.pdf

Siemens, G. (2010). What are Learning Analytics. *Elearnspace*. Retrieved January 08, 2014, from http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics/

Siemens, G. (2013). Learning Analytics: The Emergence of a Discipline. *American Behavioral Scientist*, *57*(10), 1380–1400. doi:10.1177/0002764213498851

Stewart, B. (2013). Massiveness + Openness = New Literacies of Participation? *MERLOT Journal of Online Learning and Teaching*, *9*(2), 228–238. Retrieved from http://jolt.merlot.org/vol9no2/stewart_bonnie_0613.pdf

Sultan, N. (2010). Cloud computing for education: A new dawn? *International Journal of Information Management*, *30*(2), 109–116. doi:10.1016/j.ijinfomgt.2009.09.004

Tobias, S., Fletcher, D. J., & Wind, A. . (2014). Game-Based Learning. In J. M. Spector, M. D. Merrill, J. Elen, & M. . Bishop (Eds.), *Handbook of Research on Educational Communication and Technology* (4th ed., pp. 485–503). Springer.

Trucano, M. (2013). More about MOOCs and developing countries. *World Bank EduTech*. Retrieved February 25, 2014, from http://blogs.worldbank.org/edutech/moocs-developing-countries

Udacity. (2012). Udacity in partnership with Pearson VUE announces testing centres. *Udacity blog*. Retrieved December 02, 2013, from http://blog.udacity.com/2012/06/udacity-in-partnership-with-pearson-vue.html

Van der Mey, A. (2013). Why online education won't kill your campus. *Fortune, CNN Money*. Retrieved October 29, 2013, from http://tech.fortune.cnn.com/2013/10/28/why-online-education-wont-kill-your-campus/

Wouters, P., & van Oostendorp, H. (2013). A meta-analytic review of the role of instructional support in game-based learning. *Computers & Education*, *60*(1), 412–425. doi:10.1016/j.compedu.2012.07.018

Yu, F. (2012). Mobile/Smart Phone Use in Higher Education. In M. Rao (Ed.), *Southwest Decision Science Institute Conference* (pp. 831–839). Houston, Texas, USA: Decision Sciences Institute. Retrieved from http://www.swdsi.org/swdsi2012/proceedings_2012/papers/Papers/PA144.pdf

Yuan, L., & Powell, S. (2013). *MOOCs and Open Education: Implications for Higher Education A white paper*. London, United Kingdom. Retrieved from http://publications.cetis.ac.uk/2013/667