Advancing Technology and Online Learning - An Ideal Match for the Future

In this two-part consideration of the future of online learning, we look at the patterns and trends which will shape online learning in the future and how the various components of the post-secondary education system, such as student population, course design and delivery, assessment, resource bases, teaching and learning models, and partnerships will be different from what we have now.

The first part, **A 2016 Look at the Future of Online Learning: Advancing Technology and Online Learning – An Ideal Match for the Future**, looks at developments in technology and what potential they offer for better learning, teaching, collaboration, mobility and other key aspects of online learning.

The second part, **A 2016 Look at the Future of Online Learning: Transformations in Learners, Programs, Teaching and Learning, and Policy and Government**, is a more in-depth consideration of the inter-related changes we see taking place across online learning and the implications of this for post-secondary education.

Context

Several writers are suggesting the development of online learning has reached a critical phase. Their view is all of the early adopters and first followers and their followers are “on board” and are doing what they can to enable, encourage and support the development of online and flexible learning. But there is little more they can do to encourage wider adoption, enable more expansive utilization of learning technologies and secure a significant shift in pedagogy. To reach the next level of adoption requires those who remain skeptical and those who do not like change to embrace new approaches to teaching and learning.

It is already the case that online learning is embedded in the fabric of higher education in North America, Europe and many other areas of the world. The arrival of Massive Open Online Courses (MOOCs), some of which can now be used to secure transferable credit, and the rapid development of blended learning have had an impact on these institutions and on the system as a whole. Online learning is no longer seen as novel or innovative – it is one of the tools available for teaching and learning and is in widespread use[1].

Meantime, technology advances at a fast pace. Machine intelligent and adaptive systems are now emerging quickly, enabling differentiated instruction and the personalization of learning; gamification and the use of simulation are enabling innovative approaches to science, mathematics, technology and engineering, as well as health sciences; and new approaches to assessment design, development and deployment, which make use of machine intelligence are now becoming more common.

But it is not technology that drives adoption; it is the institutional strategy, the changing nature of the student population and the decisions of individual instructors and faculty members.

Technology Developments in Support of Learning

Predicting the future of technology is always difficult and most predictions are problematic. This does not prevent a great many people from making them. There is a long catalogue of such predictions, some of which were insightful and many were farcical[2]. But there are patterns of development which we can see and which are likely to continue. Rather than making predictions, here we look at seven key patterns which we expect to shape the emerging technologies for learning.

Seven Key Technology Patterns

1. **Machine learning and artificial intelligence will increasingly be used to enable adaptive learning.**

   Advances in artificial intelligence and machine learning are occurring rapidly, as can be seen in the growth of predictive systems, robotics and new analytical products. As these developments continue, smart devices (we already have smart thermostats, fridges, and televisions) will become ubiquitous. Such smart systems will be embedded in the devices we use for learning and will begin to identify patterns of behaviour and activity, which indicate either remediation or accelerated learning. Such adaptive systems will become more and more personalized over time, as individual patterns of activity and behaviour shape the use of content, assessment and interactions. Learning management systems designed simply as delivery mechanisms for content will be replaced by adaptive systems in which interaction drives content.

2. **Handheld, mobile and integrated devices will continue to develop and become the de facto tools for learning, communication and peer networking**.

   Handheld and mobile devices are already in the possession of close to four billion people. New, faster devices, which are also lighter and cheaper, will increase adoption and will also offer more functionality and intelligent apps to support learning. The recently launched Osmo add-on for iPad enables the iPad to support a range of games for learning in three dimensions[3]. We can expect more third party add-ons and apps, which will extend the utility of such devices. We can also expect these devices to strengthen their ability to connect to social networks.

3. **Predictive analytics will grow in significance in terms of student retention and learner support.**

   Big data analytics are already in use in student recruitment centres, aiming to identify likely candidates from pools of inquirers. Such data sets are also being used to predict, from assessment data, students who are most likely to drop out or temporarily withdraw, based on their patterns of attendance, assignment submission and assignment performance. These data are used to spur active intervention with a view to increasing retention and completion. But this is the tip of the iceberg. We are likely to see much more use of data and analytics aimed at ensuring mastery of knowledge and skills and effective learning. Such predictive analytics will improve significantly the more they are used, since the aggregated data on which they depend will be continuously enriched.

4. **Interconnectivity of devices and systems will be a significant feature of the “Internet of things” and activities.**

   Homeowners can manage their furnaces from the other side of the world, monitor arrivals at their homes while in flight and deposit cheques in their bank accounts from anywhere. Connectivity and integration are the buzzwords driving the Internet of things. Look at developments in health care. Blood pressure can be monitored continuously by means of the Apple Watch and other devices; exercise trackers are embedded into smartphones; diabetes monitoring is now possible with third party add-ons to a smartphone and soon, we are advised, simple blood tests for a range of conditions will be possible through add-on devices for tablets and smartphones. Imagine these developments for learning – instant flagging of new developments in fields of study, on the fly testing for competencies and skills, instant connections to global expert presentations on topics studied in a course, and real-time viewing of skills in action for apprentices are among the possibilities.

5. **Gamification and virtual reality will enable significant advances in teaching a range of subjects,**

especially laboratory based subjects.

Simulations already exist in chemistry, physics, biology, engineering and other sciences. Significant advances in gamification and simulations, as well as the development of easier to use, faster and more innovative "creation engines" are likely or are already taking place. We can expect some of the resultant simulations and games to be available as open educational resources (OER), but many will also be proprietary. It is also likely many of these games and simulations will be designed to test skills and competencies, so apprentice electricians, for example, can be tested on their abilities largely through simulations. Some of these developments will make use of virtual reality environments, also now quickly emerging.

6. **Translation engines will continuously improve and become embedded in a great many applications.**

   When Buckminster Fuller created the "Knowledge Doubling Curve", he noticed that until 1900, human knowledge doubled approximately every century. According to IBM, the build out of the "Internet of things" will lead to the doubling of knowledge every 12 hours. To make sense of this knowledge, translation is becoming essential. The faster we are able to translate from one language to another – say, from English to Mandarin and vice versa – then the more we can make use of this knowledge for learning, development and change. Translation engines have been with us since the early 1980s, but are becoming progressively better and more useful. We are a long way from Douglas Adams' idea of the instant translator[4], which was accurate, fast and seamless, but significant improvements have been made each year for the last decade. Given the extent of learner mobility and the growth of the international student body, these developments may make learning easier for many students.

7. **Collaborative technologies and knowledge sharing will emerge as key resources for all forms of learning.**

   During the last five years, mainly as a result of the growth of social networking, products dedicated to collaboration and supporting the growth of communities of interest and practice have appeared. Some of these are focused on project management and business, but many are being used for educational networking, resource sharing, collaboration and learning. All of the major learning management systems have collaboration tools either designed in or available as add-ons. Some specialist software – e.g. NING, Core Community, Basecamp – have emerged as leaders in this space. Such systems provide for rapid and easy sharing of documents, videos, games, simulations and ideas, as well as supporting collaborative groups and focused conversations. Given the power of peer-to-peer learning and learning networks, these developments are likely to accelerate.

These seven patterns speak to trends and developments in technology, which have a direct connection to the design, development, support, and delivery of online learning.

FIVE KEY FEATURES OF ONLINE LEARNING WHICH TECHNOLOGY PATTERNS WILL ENABLE

What these seven patterns suggest is technology will increasingly support five key features of the future for online learning. These five key patterns include:

1. Learning is Mobile – Anywhere and Anytime

Given the devices students use for learning – tablets, smartphones, laptops, and occasional access to desktop technologies – a student taking a program or course can be anywhere and can study at anytime. They may have to

connect at specific times to interact with a specific person – an instructor, fellow student, knowledge expert, skills advisor, and mentor – but they can be anywhere when they do this. MOOCs demonstrated this, attracting thousands of students from around the world to work together in peer-to-peer networks to develop their knowledge and understanding. While coming together from time to time may be important, it is less important than access, affordability and flexibility to many learners.

1. **Learning is Interactive and Engaging**

   Technological developments continue to make connectivity, interaction, collaboration, networking and engagement easier and more commonplace. It is not unusual for a student to be connected to a hundred to two hundred others around the world and, when coupled with translation engines, able to connect with a great many more on an as needed basis. Whether peer-to-peer, student-to-instructor, or student-to-network of excellence, connections are all easier now than they were a decade ago. They will get easier, as well as faster, cheaper and smarter. Given collaboration is the key, not just to knowledge development and learning, but also to finding work, students will use the emerging technologies to collaborate and connect. This also leads them to expect their learning to be more engaging, collaborative and interactive. “Passive” is not part of the lexicon in the emerging learning space.

2. **Learning is Personal and Instruction is Differentiated**

   The value of machine intelligence, analytics and big data use is that it permits “the system” (meaning the technology) to better understand and predict learner needs. Adaptive learning systems – e.g. Knewton, ALEXS, Capterra, DreamBox, Cognitive Tutor, Knowillage LeaP, Planet Sherston and Grockit – enable a high degree of personalization of content and learning activities, based on active student behaviour and assessments. The students feel their learning is focused on them rather than having to be part of a class or group, and hence they feel their learning system is more personal. This, in turn, enables instructors to differentiate among students in terms of learning needs and the support provided. As these systems mature and become more refined, ubiquitous and easier to use, we will see much more personalized learning and more routes to achieving learning outcomes.

3. **Learning is Intelligent**

   Just as learning processes can be informed by intelligent systems, so too can the process of knowledge gathering and sharing. Smart content engines, linked to collaborative software and adaptive learning engines, could make learning more relevant, focused and up-to-date, especially at the graduate and advanced levels. Doctoral students can be connected not just to their own instructors, but to the communities of interest and practice associated with their field and up-to-the-minute developments. They can be much more engaged researchers, especially if the volume of new material is filtered through intelligent filters. Imagine courses which automatically update themselves, based on new research and newly available, quality assured open educational resources.

4. **Learning is Global**

   In the 1970s, a student in Sudbury, Canada could be connected to a small group of other students in their class in Sudbury and, through their instructors and attendance at conferences, a small group of others outside their local circle. A typical LinkedIn member now has some 500+ contacts with whom they can interact daily, weekly, monthly or occasionally. Using Twitter and Facebook, a big idea can find an audience of thousands in seconds. In closed or open collaborative sharing networks, some of which can be dedicated to specific topics[5], significant global expertise can be available anywhere, anytime. The resources available

for course design and development, especially given the growth of open educational resources, can also be globally sourced. There is no reason for a student to be disconnected from peers, experts or sources of knowledge and understanding from anywhere in the world, especially given the growing efficacy of translation engines. Knowledge and learning are truly global endeavours.

If these five features of online learning can be fully realized through current and emerging technologies, then online learning (whether blended or fully online) will continue to grow and develop.

Institutional Context for the Development of Online Learning

Technology enables online learning, but does not drive it or determine its growth. Institutional strategies, student demands, individual faculty decisions and the availability of resources act as the determinants of the development of online learning. But these too are changing. In particular, we should pay attention to these six features of our developing post-secondary education system:

1. **Institutions are Complex and Competitive**

   A variety of factors are making higher education more complex. There are more collaborative programs, regulatory conditions, ethical and ethnic sensitivities, research networks, joint ventures, infrastructure challenges, technology security issues, human resource challenges, financial challenges, links to business, outreach work, international students, and multi-campus locations – all of these add to the competition for students, faculty and resources. There are also many more social pressures, fuelled by social media. Changing what and how a college or university teaches is no longer an internal matter; it quickly becomes a focus for public debate.

2. **Resources are Constrained**

   Public per capita funding for post-secondary institutions in some parts of the developed world is falling at a time when demand for student places (at least in most jurisdictions) is rising. Students are paying more of their own costs for their learning and the speed and scale at which these fees can rise is constrained by both public policy and market conditions. Together, these key revenue factors determine what institutions can do and how quickly they can do it. Faculty can be an asset and a constraint: they are the dominant component of the cost structure of colleges and universities, unionized in many places with the resultant contractual obligations based on a model of teaching, learning, research and service, which may no longer fully reflect the conditions faced by institutions. Much of the post-secondary infrastructure in the developed world is aging and needs investment, as does much of the technology infrastructure. Yet it is the faculty and the infrastructure that enabled innovation and development to date. While limitations on revenue and growing costs provide constraints, the available funding also provides significant assets which can be leveraged.

3. **Demographic Shifts Impact Activity**

   College or university student populations do not look the same in 2015 as they did in 1995. There are more international students; more students for whom English is an additional language; more mature and part-time students; and more students using transfer agreements, prior learning assessment and other arrangements to fast track their degrees, diplomas and certificates. Students seek more flexibility in how programs are delivered and how they secure their qualifications. While technology is enabling this flexibility, it would be a mistake to think learners are simply demanding more online learning. What they are seeking is greater flexibility and a more personalized learning journey. Just as the student body is changing, so too are the demographics of the faculty, with more staff who are older, adjunct and part-time staff, raising new issues in

managing people within the institution. Demographics are major drivers of change in post-secondary education.

4. **Quality Is an Imperative**

   Almost every analysis of post-secondary education gives emphasis to the need for quality programs and learning experiences for students. In a highly competitive environment, quality is a key factor in student and faculty choice and in the decisions made by governments to invest or divest. Universities and colleges seek recognition for their quality and efficacy, seeking accreditation for professional programs, student services and other activities, to be able to demonstrate quality. As quality requirements change – with the evolving inclusion of student engagement, online learning design and the learning outcomes based on achievement measures – so colleges and universities adapt. While the evidence is strong that online learning is not significantly different from other forms of learning design in terms of learning outcomes[6], demonstrating this consistently across a range of programs is now essential.

5. **Change Is Inevitable, but Difficult for Colleges and Universities**

   Factors listed in this document and elsewhere are leading to substantive and significant changes in the design, development and deployment of programs and courses within universities and colleges worldwide. They are also leading to downsizing, mergers, closures and acquisitions, particularly in the private college and university sector. Change is difficult (Koelbl, 2015[7]). Some systems are adjusting. For example, all public universities in Malaysia are now accessing MOOCs for first and second year students, following a decision by the government. They use proctored examinations for credit completion, with the resultant credits being transferable to any university in the Malaysian public system. Another example is the Kentucky Community Technical College System which offers enrollment in its micro-courses (all of which carry credit) 365 days a year. Others are changing more modestly and incrementally so as to secure the buy-in of faculty, students and the public. But change is occurring now more rapidly than in the past. This does not make it easier nor are all of the changes successful.

6. **Relevance and Value Shape Strategy**

   There are increasing demands for programs and courses to be relevant and create value. Governments are asking colleges and universities to bridge the skills gap between the needs and demands of employers and the available skills in the workforce[8]. Governments are also asking for a return on their investment in higher education. Outcome-based performance metrics are to be used to demonstrate where the value of a credential is linked to employment, earnings, health, social contributions and other factors. At the same time as governments change or reduce their per-capita funding to institutions, they are demanding more reports and accountability statements showing productivity, performance against outcome targets and efficiency. The challenge here is the skills needed for the economic development of a jurisdiction change quickly – who can predict what skills will be needed to support a knowledge-based economy as it evolves?

What is clear from these six observations, and the points raised by many others[9], is our higher education systems are in transition from an established and clear model to new and uncertain models in response to a different future. These changes are being driven by a variety of factors, but the key to success is the development of a coherent, focused and systematic strategy for development, which takes full account of the realities of the challenges which institutions face in terms of learners, programs, teaching, and policy. The second part of this series addresses those changes and their inter-related impacts on all aspects of institutions and of learning,

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[1] For a review of the development of online learning, see Dziuban, C. and Picciano, A.G. (2015) The Evolution Continues – Considerations for the Future of Research in Online and Blended Learning. *ECAR Research Bulleting (Educause*), June 17.

[2] For a fun collection, see http://www.buzzfeed.com/lukelewis/26-shockingly-bad-predictions#.yjE0zOMxZ

[3] For more information, see http://blogs.wsj.com/personal-technology/2014/05/22/osmo-digital-toy-aims-to-bring-ipad-addicted-kids-back-to-real-life /

[4] Douglas Adams. (1979). *The Hitchhiker's Guide to the Galaxy*. London, Pan Books.

[5] For example, see https://blab.im/

[6] See the accumulated evidence at No Significant Difference - http://www.nosignificantdifference.org/

[7] Koelbl, J.J. (2015) The Brink of Closure – What Motivates Higher Education to Change? *Educause Review*, September 1st 2015.

[8] An example of the skills gap in Canada can be found in the Conference Board of Canada (2013) *The Need to Make Skills Work: The Costs of Ontario Skills Gap*. Ottawa: Conference Board of Canada.

[9] See, for example, The Future of Higher Education – an online conversation at https://theconversation.com/au/topics/future-of-higher-education (Retrieved November 18th 2015).