How Ten Key Developments Are Shaping The Future Of Technology-Enabled Learning

teachonline.ca /print/tools-trends/how-ten-key-developments-are-shaping-future-technology-enabled-learning

In documenting ten key developments, we are not suggesting these are the only developments occurring, or the order in which these are presented, represents any kind of ranking or prioritization or each one applies in all contexts. Rather, these are developments which we see as having the potential to impact, in different ways, the strategic plans and actions of colleges and universities around the world.

Here are the ten key developments:

1. Student Expectations and Requirements Are Changing

2. Flexibility is Shaping New Ways of Delivering Programs and Courses

3. Competency-based and Outcome-based Learning Are Growing Quickly

4. Technology is Enabling New Approaches to Pedagogy

5. MOOCs are Offering Expanded Routes to the Delivery and Recognition of Learning

6. Assessment *for* Learning and Assessment *of* Learning Are Changing

7. Governments are Re-thinking Quality and Accountability

8. Equity Remains a Challenge, Despite Massification

9. e-Portfolios Are Emerging as Critical Resources for Students

10. The Role of the Faculty Member/Instructor is Changing

Let us now look briefly at each in turn.

1. Student Expectations and Requirements Are Changing.

Demand for higher education from recognized, quality institutions continues to grow, but who is making this demand and what they expect are likely to change significantly. In particular:

- More mature students, who are seeking flexible learning options, seek access to, and success, in programs. This in turn requires programs to provide varied routes to completion.

- More seniors are seeking opportunities to learn, but not necessarily for credit or credentials.

- Greater expectations for the use of technology-rich environments for learning, for access to resources, and for communication and collaboration with instructors and other students.

- More local and international students seeking credential completion, having started programs elsewhere, but not willing to start again. This demands effective prior learning assessment and recognition (PLAR), work-based learning agreements, and recognition of foreign credentials through national and transnational qualification agreements, as well as partnerships, alliances and joint programs.

- More local and international students seeking credentials from universities, but doing so on the basis of a competitive value proposition when compared to other competing universities in the region.

- More students seeking programs that offer knowledge and applied workplace skills, as well as high-level skills in group work, communication, project leadership, etc.

- More students seeking shorter programs, which are skill-based and work-ready – the demand for micro-credits will grow.

The changes in the composition of the student body at colleges and universities varies according to the institution and the region of the world, but student technological sophistication and the demands of the workplace combine to require new thinking and new strategies.

2. Flexibility is Shaping New Ways of Delivering Programs and Courses.

The University of Wisconsin offers a route to a degree based on competency assessment. Courses are not required, but rubrics for competency are very clear and explicit, making learning focused and direct. The university suggests appropriate learning resources for students to use to support program completion, in this "flex option" program.

Students can use the mentoring and coaching services of the university when they feel the need of assistance, but pay a fee for these services. When ready, the student calls for a mastery assessment. Such a program is similar to the Western Governors University (WGU) offering of competency-based degrees.

Wisconsin and WGU are not alone in developing these flexible routes to degrees. In the United States, Southern New Hampshire University, Capella University, Kaplan University and Walden University are all offering this same route to a degree. In his call for free college education in the United States in 2013, President Barack Obama recognized these developments as "game changers" for learning and skills[1].

Flexibility of routes to a degree is an emerging mantra for presidents and vice chancellors of colleges and universities in North America and Europe. Given the focus on student achievement of learning outcomes, how they achieve these outcomes can vary. Technology enables us to track students' abilities as demonstrated through assessment and should make flexible learning a cornerstone of a college or university education in the near future.

3. Competency-based and Outcome-based Learning Are Growing Quickly.

Many school systems are moving from a broad, knowledge-based curriculum to a skills- and competency-based model for learning. Outcome-based and competency-based learning are becoming dominant forces in curriculum re-

design in an increasing number of colleges and universities.

In part, this is driven by the new emphasis from governments on skills and bridging the gap between what employers are seeking and the skills of post-secondary graduates. In part, this is linked to globalization and the global war for talent. But critically, it is linked to the reality that colleges and universities need to be seen as critical producers of highly qualified people that can drive socio-economic development.

The move to competency-based learning is also evident amongst professions, which demand graduates of colleges and universities to complete competency- and skills-based professional assessments as a pre-requisite for entry into a profession.

4. Technology is Enabling New Approaches to Pedagogy.

The technological landscape is in a constant state of evolution; some would say revolution. Hand-held devices now surpass desktop computers in terms of ownership and use. Growing access to broadband (still not universal) has changed access to knowledge, information, services and support. The emergence of online learning has transformed access to learning for a great many students and has changed the dynamics of higher education.

These five developments, driven by technology, seem most likely to have an impact on teaching and learning:

1. Artificial intelligence and machine intelligence generates new ways of assessing and supporting students, using adaptive learning systems and automated assessment. Such developments may also lead to growing use of robotic technologies to support learning and student services.

2. Enhanced simulations and games using augmented reality permit life-like laboratories in science, engineering, music, art and other disciplines, but also make remediation for struggling students more effective when combined with adaptive learning technologies.

3. More visual and aural learning is available. With the growth of voice and gesture recognition, and an increase in computing power, students may make more use of audio, video, graphics, gesture and 3D imaging in their study and in their assignments.

4. More personalized and differentiated approaches to teaching and learning use adaptive learning and analytics. As the technology becomes more ubiquitous, learning can shift from batch-processing (classes with an instructor) to a more individualized and self-paced experience.

5. Far more extensive use is made of open educational resources (OER) by both students and their instructors, because of ease of access, low cost and quality assurance being attached to such resources.

While in the past, the barrier to accelerated adoption of such technologies has been the willingness of faculty members and instructors to utilize them, student behaviour and the growth of private providers for higher education in some jurisdictions leads to more colleges and universities adopting these technologies not simply for competitive advantage, but also for better teaching and learning.

5. MOOCs Are Providing Expanded Routes to the Delivery and Recognition of Learning.

More people signed up for MOOCs in 2015 than in the previous 3 years combined. In total, some 35 million students registered for a MOOC with *Coursera*, securing 7 million new registrations in 2015, with this company now occupying some 50% of the MOOC market. The UK Open University-affiliated *FutureLearn* is now the third largest MOOC provider - they secured growth of 275% in 2015. Around 1,800 new courses were announced in 2015, taking

the total number of courses announced since the inception of MOOCs to 4,200[2]. Over 500 colleges and universities around the world, not to mention other organizations, are now offering MOOCs - they are here to stay.

A new set of credentials to recognize knowledge, competency and skills secured through the completion of MOOCs is developing quickly. Students have more options and choices about how they demonstrate mastery, including badges, specializations, nanodegrees, XSeriesMOOCs and HBXCORe.

Let us look at these new kinds of credential opportunities:

- **Badges**: Launched in 2011 using an open architecture and standards, badges have been slowly gaining acceptance ever since. Once a person masters a competency and has been assessed and is successful, a badge showing mastery is placed in a portable e-portfolio. Students can make their portfolio available for review by prospective or current employers or educational providers. While some are trying to commercialize this development[3], most are seeking to leverage these developments to advance competency-based learning and credentials.

  More than 14,000 independent organizations are already issuing badges to document formal and informal learning and workplace training, providing more ways for students and workers to get verifiable recognition that can lead to increased access to opportunities for further education and career success.

  The McArthur Foundation is supporting a network of such organizations – the Badge Alliance[4] – to leverage and accelerate these developments. Badges are now offered through MOOCs by George Washington University and many others.

- **Specializations**: *Coursera* began specializations in 2014 and now has some 83 specializations, consisting of a group of related courses designed to help students deepen expertise in a subject. According to *Coursera*, 1.5 million *Coursera* students signed up for courses that are part of a specialization.

  To earn a Specialization designation, students must achieve a verified certificate in every course that is part of a specialization. The final step is a capstone project – a project that demonstrates the knowledge acquired during the specialization. The cost of a specialization lies in the range of $150 – $500 US. An example is the Methods and Statistics in Social Sciences specialization developed by the University of Amsterdam, which comprises of four courses and a capstone project.

- **Nanodegrees**: *Udacity* began offering nanodegrees in partnership with companies and major employers in June 2014. Partnering with companies such as Google, AT&T, Tata and others, *Udacity* creates custom MOOCs, which meet the competency and skill needs of these employers. All of the nanodegrees are in information and communications technologies (ICT) at this time, but they readily are created for, and offered in, a range of other subjects. Some of these nanodegrees come with job guarantees.

- **XSeries MOOCs**: Launched by MIT through *edX* in 2013, each XSeries covers content equivalent to two to four traditional residential courses and take between six months and two years to complete. In a break from previous offerings, the XSeries sequences are composed of shorter, more targeted modules without one-to-one residential course equivalents.

  These programs offer certificates of achievement, but not academic credit. Many have been developed for specific industrial needs (e.g. supply chain management), but are not linked to particular companies.

- **HBX CORe**: This is the Harvard Business School offering a "credential of readiness" in the fundamentals of business thinking (CORe). Irrespective of their academic backgrounds, students take three modules: Business Analytics, Economics for Managers, and Financial Accounting over ten weeks of study.

  The aim is to enable basic competency across these three components of business practice. HBX CORe costs $1,800 US ($3,600 if credit is required).

We can expect to see more credentials and platforms linking badges, nanodegrees and other forms of recognition of learning through e-portfolios. As competency-based learning gathers pace, and as more employers demand proof of competencies, these forms of recognition for learning will grow in scope, quality and relevance.

What has not yet happened, but will, is the needed renaissance in assessment (Hill and Barber, 2014)[5]. Rich assessments, based on demonstrating understanding, showing skills in action through simulation or immersive challenges, are needed to further refine the move towards a more holistic form of skills assessment.

6. Assessment *for* Learning and Assessment *of* Learning Are Changing

Technological developments are enabling a re-thinking of how, how often and where students are assessed. There is a distinction drawn between assessment and review intended to facilitate the next stage of a student's learning (assessment *for* learning) and the summative assessment of a student's knowledge, skill and competencies (assessment *of* learning). These developments in particular appear important:

- **More advanced automated assessment – item generation, assessment design and marking.** We already have highly efficient and effective basic test item generation and marking systems for multiple choice and short form essay items, such as those just described. We are getting closer to long form essay marking systems.

- **Providing meaningful tutoring at any time**. Artificial Intelligence (AI) systems can appear very human and very well informed, which is why AI counselling systems online are seen to be effective. AI tutoring systems are already emerging – mainly in the areas of mathematics, writing and basic science. The range and quality of these services will quickly expand, especially since tutoring is a fast growing business.

- **Predicting student behaviour and outcomes**. Can we predict when a student will drop out, fail or find a particular section of a course difficult? Using behavioural analytics, analysis of past student behaviour in an online course and in other courses, tools exist which can provide predictive analysis and encourage active intervention to prevent dropout, failure and enable a higher level of student success.

- **Adaptive learning systems.** If you login to an Amazon account, their AI engines suggest books or items you may be interested in, based on past patterns of searching and buying. Google adjusts search results by location and past search behaviour. As these systems become more sophisticated, they are integrated into adaptive learning engines, which change the content of a course based on student behaviour and performance. As the student completes self-assessments, the system changes the next set of materials they see to reinforce areas of strength, and significantly enhance activities and resources linked to areas of weakness. More recently, such systems also adapt to the learning styles of the user, based on observed patterns of behaviour.

- **Enabling trial and error / prototype learning.** Trades education involves trying to do something (a weld, a

dovetail joint, an electrical installation, plumbing in a bathroom) under supervision and then improving performance the next time the task is completed. Using simulations and immersive environments (virtually reality), students can practice these skills with an AI tutor who can provide feedback in a neutral environment. Students can repeat these activities at any time and not feel that they are taking too much lab or class time or that their performance is having an impact on how their real-life tutor views them. Such systems exist in other fields as well, such as counseling, nursing, and environmental sciences, and are being enhanced all the time.

Several of the developments outlined here provide the focus for a great deal of private capital investment in education and represent a significant focus for the major technology players – Apple, Facebook, Google, McGraw Hill, and Pearson. Some colleges and universities are partnering with these organizations and others are leveraging their own resources to move in these directions. The costs of adoption are coming down and the opportunity to improve student retention, completion and depth of learning outcomes appears real.

7. Governments are Re-thinking Quality and Accountability

A recent publication from the Council for Higher Education Accreditation (CHEA) – *CIQG International Quality Principles – Towards a Shared Understanding of Quality*[6] – documents developments in our understanding of quality. In particular, important chapters on the shifting understanding of quality by governments and the growing emphasis on the student experience clearly show our notions of quality are changing.

People go to colleges and universities for different reasons. Some want to fast track through and get their credential. Others want to think, engage and learn through discourse, dialogue and challenge. Technology can help with all kinds of aspects of learning, but in the end, the key is relationships:

- Relationship between the student and the knowledge base

- Relationship between the student and his or her faculty member/instructor

- Relationships between the student and other students

- Relationship between the student and others in the same area of study beyond the class or institution

- Relationship between the knowledge and skills being developed by the student and the real world uses or applications of that knowledge

- Relationship between the faculty member/instructor and the knowledge base

- Relationship between the faculty members/instructors and his or her peers in that discipline

- Relationship between today's knowledge and the creation of tomorrow's wisdom

- Relationship between the faculty member/instructor and those who can support the work of teaching and learning for that discipline

A quality assurance system for post-secondary education could focus on documenting and analyzing these relationships and their value as predictors of learning outcomes and student performance. Technology developments would enable this to occur.

8. Equity Remains a Challenge, Despite Massification

Drew Faust, President of Harvard, suggested at the World Economic Forum in Davos that education is the route by which inequality around the world will be ended. She points to recent developments in technology enhanced learning as the core of her case:

> *"The relatively recent proliferation of online learning opportunities has enabled universities to reach people around the world in ways that would have been unimaginable just a few years ago. Some 6 million students have enrolled in more than 650 courses provided by edX, a platform co-founded by Harvard and MIT, and they represent just a fraction of individuals who have discovered communities of like-minded students online. These efforts do more than share knowledge far beyond our campuses. They encourage and test new approaches and methods, and they create unprecedented amounts of data that are shedding light on the most effective methods of teaching and learning."*

She may be right, but unless things change significantly, she is overly-optimistic.

She is looking at the power and potential of MOOCs as the basis for her optimism. Yet a recent study of those taking MOOCs by researchers from Harvard and MIT, reported in *Science*[7], suggests the profile of successful MOOC graduates closely resembles that of many current participants in higher education and is not leading to greater equity in terms of educational outcomes.

While there are extraordinarily talented students from all backgrounds who succeed in MOOCs, those from more affluent and better-educated neighbourhoods are more likely to enroll and succeed in these courses. Moreover, the relationship between socioeconomic resources and course success is strongest among teens and college-aged students, exactly the ages where we might hope MOOCs could provide a new entry point into higher education[8].

This is not surprising. David Berliner, Regents' Professor of Education Emeritus at Arizona State University, observed, based on systematic data analysis[9], that educational outcomes, such as outcomes measured by standardized tests or formal assessments of learning, are much more about social class as they are about teaching and learning. MOOCs are only one aspect of the search for greater equity in access to, and success in, higher education, but the composition of their student base reflects many of the same characteristics as that of traditional higher education.

9. e-Portfolios Are Emerging as Critical Resources for Students

Learner mobility is a major tenet of public policy and is fast emerging as a key issue for the future of higher education. With a growing number of transnational qualification agreements (e.g. European Qualifications Framework, South African Development Community Qualifications Framework, Transnational Qualifications Framework of the Small States of the Commonwealth, Caribbean Qualifications Framework, Association of South Asian Nations Framework Agreement)[10], many of which are now reciprocal, students have greater mobility now than they have ever had before. Further, national and regional systems of credit transfer, work-based learning accreditation and prior learning assessment and recognition (PLAR) are all making the life of registrars more difficult. Securing transcripts, interpreting transcripts, assessing equivalencies, and valuing credit and credentials is now a complex task.

The idea of the e-portfolio is not new; the first examples began to emerge in the mid-1990s. What is new is the more extensive use of e-portfolios. In November 2015, for example, Cal State rolled out a major initiative to make e-portfolios available to more than 3 million students and alumni. Also last month in the United States, 80 of the country's most selective institutions — including the Ivy League schools Stanford, University of Chicago, Amherst, Swarthmore and Williams — announced a plan to offer free e-portfolios to high school students so they can begin tracking their skills, achievements and work and engage in reflective learning. It is estimated, worldwide, over 30 million students now maintain e-portfolios.

e-Portfolio accounts are available for individuals anywhere, with providers hosting the functionality and data on their servers. Many e-portfolio providers also offer simple ways of using a smartphone or tablet to capture evidence and to upload the evidence. Being able to collect and reflect on their own work, whether in class assignments, community-based projects, or individual initiatives, allows students to see changes over time, in itself an important learning experience.

Employers can look beyond the certificate, diploma or degree to spot patterns across student work, assess its relevance to workplace demands and use predictive algorithms to parse competencies and match candidates to job descriptions. Data from e-portfolios also allows employers to identify future talent, develop a candidate pipeline and begin meaningful engagement through internships to evaluate student work firsthand.

We are starting to see e-portfolio and MOOC integration in some of the more recent MOOC offerings [11] (there is even a MOOC on how to develop and use e-portfolios[12]). Students themselves are making this happen, using simple and effective low-cost tools[13], something institutional leaders need to notice.

10. The Role of the Faculty Member/Instructor is Changing

When we put these developments together, the nature of the offer colleges and universities make to their students and the value proposition they make to governments are slowly changing. This inevitable involves changes to the role of the faculty member/instructor.

But the Rogers adoption curve is still in play. Shown below, this curve is used to explore the speed at which technologically-driven change is adopted by members of an organization. Rates of adoption vary, but in North America, the evidence suggests[14] there is still a long way to go to persuade faculty/instructors that blended, online and flexible approaches to learning represent quality, meaningful and valuable approaches for students in their subject.
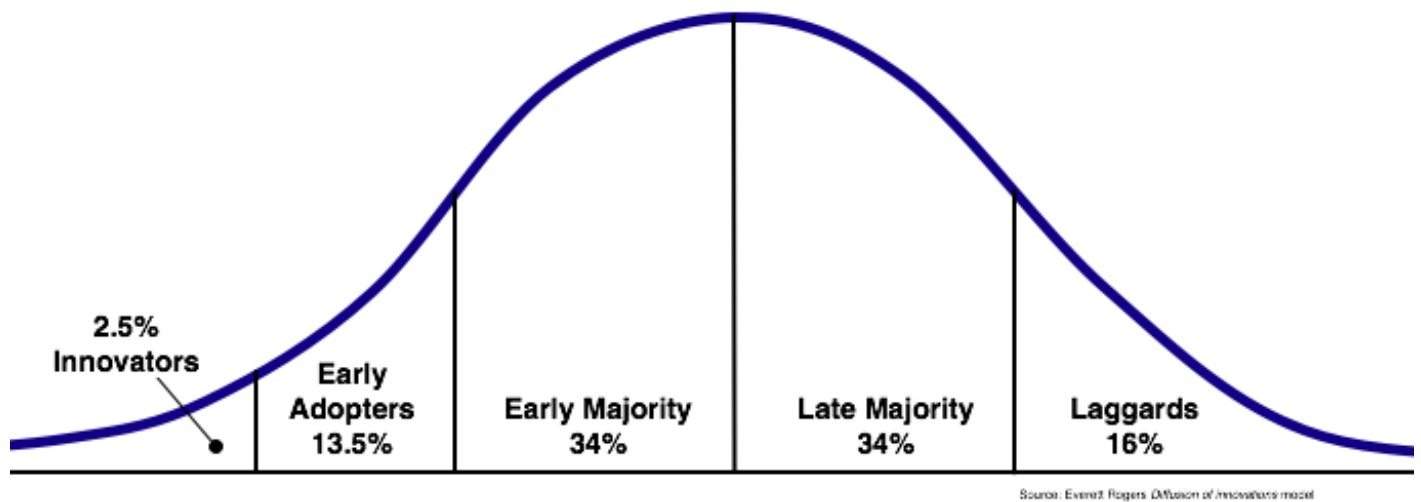
2.5% Innovators

Early Adopters 13.5%

Early Majority 34%

Late Majority 34%

Laggards 16%

Source: Everett Rogers *Diffusion of Innovations model*

Figure 1: Rogers Adoption Curve

Given all of the developments outlined here – and there are many more – what is it that faculty/instructors now need to do?

The knowledge, skills, understanding and social networks, which faculty/instructors have, can be more fully leveraged in the interest of students and learning. This work includes, but is not limited to:

- In partnership with employers and other faculty members/instructors, determine what the needed knowledge, skills and competencies are for a particular set of learning outcomes.

- Design and develop a range of rigorous, multifaceted assessments for the knowledge, skills and competencies making best use of all available technologies for assessment.

- Design, in partnership with other faculty members/instructors, instructional designers and librarians, the learning pathway and resource recommendations for students making best use of open educational resources, third party multimedia and more traditional resources, and community resources.

- Create, either on their own or with others, new open educational resources, which fill gaps they observed in the available resource base.

- Design, in partnership with instructional designers and others, alternative routes for students who are most able and those who are least able, given the learning outcomes and competencies they are expected to master.

- Be available to mentor, coach and guide students on an as-needed basis.

- Participate in professional development activities aimed at improving assessment, outcome-based learning, the development of OER material and learning pathways.

- Use social networks to connect to others engaged in teaching, research and development in their field and find new ways of connecting their students to these networks.

- Translate research findings in their disciplines into action and development.

This work fully leverages both the content and professional instructional expertise of faculty/instructors, but also places them in a different relationship to students than is currently the case. They are co-creating and navigating a learning journey rather than instructing. All of this work can be aided by technology, especially collaborative technologies.

Re-think what we are doing and how we are doing it.

This has been a rapid exploration of the future of technology-enabled learning.

The future is, as we can see, different and challenging. But this review also provides an opportunity to re-think what we are doing, how we do what needs to be done and who we are able to serve. It is an exciting time. Given the range of things happening, some of which are captured here, courageous leadership is needed to take our colleges and universities to the next level.

[RS1]Nicole, can you check with Simon and see if this page could be setup as follows:

Opening text (see yellow highlight at beginning of document)

The number list of the 10 items in an accordion format so when you click on the item, it opens to reveal the text and you can close to move onto the next ones)

Concluding text (see yellow highlight at end of document)

This could create a more compact page that avoids unnecessary scrolling.

- Accessibility
- Disclaimer
- Privacy Policy
- Careers
- Contact Us