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CONNECTING THE DOTS: TECHNOLOGY-ENABLED LEARNING & STUDENT SUCCESS

NELSON Education

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Nelson publishing is to be congratulated on bringing together a select group of those working on innovation, change and transformation in Ontario's higher education system.

Online learning is an established, integrated part of the higher education learning landscape in Canada and other parts of the world. In the US, for example, 2.85 million learners are studying their college or university program entirely online and an additional 5.8 million will take one or more fully online course as part of their program of studies. Blended learning is increasingly the standard for how teaching in higher education is undertaken. Technology-enabled learning is a world-wide feature of higher education.

But there are challenges. Not all faculty, even in colleges and universities with a strong commitment to online learning, support online learning – some 35-45% do not consider online learning of sufficient quality or efficacy. Not all courses have high levels of student engagement and some provide few opportunities for students to construct their learning. Not all online programs and courses are well designed – indeed, one massive open online course (MOOC) offered by Coursera was withdrawn after one week because it was so poorly designed. Ironically, the course was Fundamentals of Online Education: Planning and Application.

If online learning is to continue to develop, expand and become even more central to all of our higher education systems, then we need to expand some key boundaries, experiment with new approaches and test new limits, especially in the following three key areas:

1. The notion of "program"
2. The role of faculty
3. The nature of student support services

Let's look at some challenges and opportunities with a view to stimulating an inspired conversation.

Key Issue 1: The Notion of "Program"

The University of Wisconsin started to offer a competency route to a degree based on creative and thorough competency assessments. Known as the "flex option", 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 learners to use to support program completion. Students can use the mentoring and coaching services of the University when they feel the need for assistance. When ready, the student calls for a mastery assessment.

Such a program in similar to the Western Governors University offerings where degrees are based not on time served or courses completed, but on competencies demonstrated. These institutions are not alone in doing so. In the United States, Southern New Hampshire University, Capella University, Kaplan University and Walden are all offering this same "flex" route to a degree. In his call for free College education in the United States, President Barack Obama recognized these developments as "game changers" for skills[1].

This flexible model is growing quickly in the US and around the world. It marks the end of the Carnegie unit – time served in class coupled with

1 Speech in Buffalo, New York, August 22,2013.

course-based assessment – as the basis for program completion and the beginning of a movement to "unbundle" education. But these are simply different routes to completing the requirements of a program. Wisconsin, Capella, Kaplan and others pursuing this flex approach are still defining what a student needs to know so as to qualify for their degree.

But is this how it will be in the future? 35 million students registered for one of the 4,200 MOOCs available and it is the case that many adult learners are constructing the programs that matter to them, often combining subjects and interests which colleges and universities are yet to identify as opportunities – like food engineering technology, genetic forestry, and computer furniture designer. They are re-defining a program of study as something they construct and our faculty, colleges and universities support and recognize.

To make this more concrete, the National Research Council dedicated $20 million over five years (2014-2019) for the Learning and Performance Support Systems (LPSS) which is described as follows:

> In the long term, working with strategic industry partners, LPSS will develop a learning and performance support infrastructure that will host and deliver the following key services:
>
> - Learning services and a resource marketplace, providing content and service producers with unfettered access to customers, and employees (and prospective employees) with training and development opportunities;
> - Automated competency development and recognition algorithms that analyze workflows and job skills and develop training programs to help employees train for specific positions;
> - A personal learning management tool that will manage a person's learning and training records and credentials over a lifetime, making it easier for employers to identify qualified candidates and for prospective employees to identify skills gaps; and
> - A personal learning assistant that enables a student or employee to view, update and access training and development resources whether at home or on the job, at any time.
>
> The LPSS infrastructure includes underlying technologies to support these services, including identity and authentication services, cloud access and storage challenges, personal records and credentials, document analysis and analytics, and interfaces to third-party services such as simulation engines and other advanced training support services.

In short, this work enables learners to design, develop and track their learning – learning that matters to them.

Many learners will still follow prescribed programs. Indeed, they will have to so as to qualify for a Red Seal trade, or as a nurse, accountant, lawyer or many other "regulated" professions or trades. But so many of the jobs available now, and , yet to be created, are not regulated or controlled – learners can and will construct their own learning playlists for the knowledge and skills they need to be successful.

What self-managed learners need is recognition and certification. This means our colleges and universities need to focus on competency-based assessments for prior learning, work-based learning accreditation, quick and automatic block transfer arrangements and recognition of skills

for partial credit. They also need to stop thinking that quality is about residency, time in class of being taught by "their" professor.

Success may not be just about successfully completing programs designed by a college or university: it may increasingly mean securing recognition and certification for programs the student has designed for themselves.

Key Issue 2: The Role of Faculty+

The role of faculty is changing quickly for a variety of reasons. For one, the speed at which knowledge is changing is increasing. Buckminster Fuller created the "Knowledge Doubling Curve". He noticed that until 1900, human knowledge doubled approximately every century. By the end of World War II, knowledge was doubling every 25 years.

Today things are not as simple as different types of knowledge have different rates of growth. For example, nanotechnology knowledge is doubling every two years and clinical knowledge in medicine every 18 months. But, on average, human knowledge is doubling every 13 months. According to IBM, the build out of the "internet of things" will lead to the doubling of knowledge every 12 hours. So as to stay current as an educator, not to mention researcher, faculty members must be networked, connected and collaborators.

Second, teaching is more complex. Not only do we have access to more knowledge, but the technology available to support learning is substantial and changing all the time.

Here are some technologies which are emerging and which will impact college and university learning:

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 analytics products. As these developments continue, "smart" devices (we already have smart thermostats, fridges, 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 require 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 system in which interaction drives content.

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

   Hand held and mobile devices are already in the possession of close to 4 billion persons. New, faster devices, which are also lighter and cheaper, will increase adoption and use of these devices, which will also carry more functionality and will have 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[2].

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 top 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 significantly improve, 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, check who is arriving at their door while in flight and deposit cheques in their bank account without leaving home.

   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, simply blood tests for a range of conditions will be possible through add-on devices for tablets and smartphones.

   Imagine these developments for learning – new developments in the field of study are flagged instantly, on the fly testing for competencies and skills, instant connection to global expert presentations on topics studied in a course, and real-time viewing of skills in action for apprentices.

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. Second Life and other similar products remain in use. What is likely to occur is the significant advances in gamification and simulation and the development of easier to use, faster and more innovative "creation engines", making the development of simulations and games easy for those without significant experience.

   Some of these already exist, but others are in development.

2 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/

We can expect some of the resultant simulators and games to be available as open educational resources (OER), but many will also be proprietary. It is also likely that many of these games and simulations will be designed to test skills and competencies, so that apprentice electricians, for example, can be tested on their abilities largely through simulators. 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.**

   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 growing knowledge "mine", translation is required. The faster we are able to translate from one language to another – say, from English to Mandarin or Cantonese 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, with wearable simultaneous devices becoming available in 2016. 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 social media – enabling rapid connectivity between learners, instructors and global experts – enabling knowledge sharing 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 "collaboratories" 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 and simulations, 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.

Faculty will be expected to leverage these technologies so as to increase access, offer higher quality and engaged learning and accelerate completion. Many are poorly equipped to do so, especially in terms of their knowledge of learning as a design science.

To make matters more demanding from a faculty members point of view, students being taught are also changing – classrooms and cohorts are more complex. In part this reflects shifts in Canada's demography, the increasing reliance of institutions on international students and the growth of the high fee paying "customer" student. The range of knowledge, skills and abilities within a class continues to become more

varied, placing demands on faculty to differentiate their instructional strategies and personalize learning.

While some faculty are clearly able to respond to these challenges – indeed, many thrive as the Pockets of Innovation Series on teachonline.ca (www.teachonline.ca/pockets) demonstrates – there are a large number who are finding changing their teaching and learning strategies difficult. This in turn affects student engagement and completion.

If the best predictors of learning outcomes are student engagement[3] and faculty satisfaction, do we need to do more to help faculty adapt their teaching and adopt some of the principles of agile design, constructivist learning and learning strategies? Do institutions need to focus less on the academic qualifications of their faculty (which are nonetheless important) and more on their understanding of instructional design, student engagement and assessment?

Student success is in part a function of faculty satisfaction and the ability of faculty to design deep and mindful learning experiences for the learners with whom they are working with. If we want more students to succeed, then we should focus more on student engagement and learning design and faculty need to be highly engaged in this work. We also need to explore the necessary conditions of practice for faculty to be successful as teachers. Many are not working under optimal conditions for efficacy.

Key Issue 3: The Nature of Student Support Services

Faculty matter. But, to students, so do those who work in finance, registry, careers, residency management and in other roles in the institution. Many students drop-out or drop-down not because of their courses or faculty, but because of the quality of the non-academic services they receive.

Below is a map of the services a college or university normally provides and has to provide for on-campus as well as off-campus students.

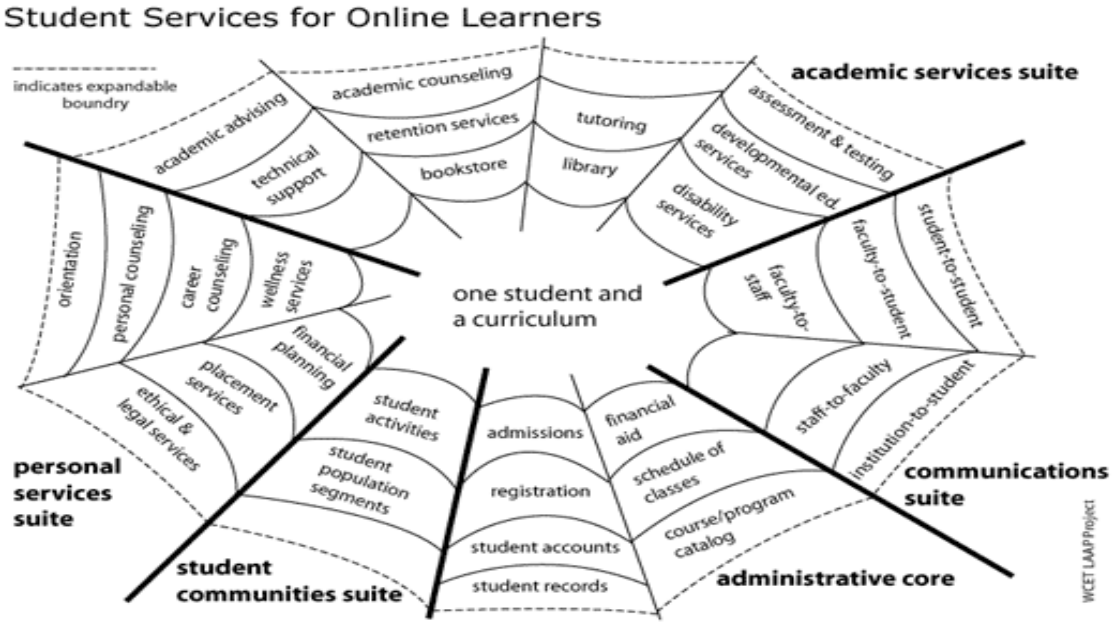

Figure 1: The Range of Student Support Services

3 See this review of the literature: http://elearnmag.acm.org/featured.cfm?aid=1722023.

Each of these activities has to be re-engineered to go from a program with one hundred students to a program with 1,000, 10,000 or 300,000 students if, that is, the college or university wants to have a strong reputation for quality and excellence and wants to strengthen its presence in its chosen markets rather than weaken its position. Remember: the largest single MOOC in 2015 had over 400,000 students.

There are a total of thirty-one separate functions on the diagram which need to be thought of in terms of quality, impact and scalability. Some may not be needed. For example, the extensive use of open educational resources may eliminate the need for a bookstore and the course can be designed to eliminate the need for ethical and legal services.

Still, a lot of re-engineering of services is also something colleges and universities try to avoid – "we have ways of working which work for our normal operations but will not work well for this scale…" is what is often said. What this comment fails to recognize is that, as students pursue more flexible routes for their learning, each of these services needs to be re-designed so they have a positive impact on the student experience rather than a negative one.

A key barrier to increased success is the lack of adaptability of the non-academic functions and supports within many colleges and universities. To increase student success, these functions need to adapt and change so as not to be potential points of failure in the student journey.