eCampusOntario Educational Technology Sandboxes: Reports and Recommendations

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Contents

Acknowledgements vii

Educational Technology Sandbox Overview 1

Educational Technology Sandbox Concept 1

Open Badges 2

Virtual Lab Simulations (Labster) 3

Experiential Learning (Riipen) 3

Educational Technology Sandbox Report Collection and Evaluation 4

Open Badges: CanCred

Key Findings: Open Badges 9

Durham College 19

Fanshawe College 25

Georgian College 29

Loyalist College 35

Ryerson University 39

University of Waterloo 43

Western University 51

York University 71

Open Badging: Additional Resources 77

Virtual Simulations: Labster

Key Findings: Virtual Lab Simulations 81

Cambrian College 87

Canadore College 91

Centennial College 101

Durham College 111

Lambton College 115

Mohawk College 119
Sault College 123
University of Guelph 127
University of Ottawa 133
University of Toronto 137
University of Windsor 145
York University 151
Virtual Lab Simulations: Additional Resources 159

Experiential Learning: Riipen

Key Findings: Experiential Learning 163
Experiential Learning Overview 163
Fanshawe College 167
La Cite Collegiale 173
University of Windsor 177
Experiential Learning: Additional Resources 181

Appendix A: Badging at Ryerson University 183
Appendix B: University of Waterloo Badges 187
Appendix C1: Badging Variety at Western University 189
Appendix C2: Ivey Business School Debrief on Badges 197
Appendix D: Canadore College Survey Responses 199
Appendix E: Sault College Virtual Lab Simulations Integration Details 201

Acknowledgements

The *eCampusOntario Educational Technology Sandbox: Reports and Recommendations* is the result of a year-long educational technology evaluation project initiated by eCampusOntario with participating partner institutions. The institutional reports included in this publication were written by the project leads and, aside from small editorial changes, are in their own words.

This work would not be possible without the contributions of the following individuals:

- The project leads and their teams at each of our participating institutions, who embraced the challenge of implementing and evaluating the educational technologies.
- Don Presant, for his open badging guidance and support for the CanCred exploration.
- Sam Butcher, Emma Durand, and Laura Wirpcza for their Labster expertise and support.
- Emily Masching, Dana Stephenson, and Richard Tuck for their advice and direction with Riipen.
- The entire eCampusOntario team with special thanks to Peggy French, Terry Greene, Jenni Hayman, and Michel Singh, for their encouragement and support.

We are also grateful to Pressbooks for providing a platform to deliver our findings. With its inherent flexibility, it allows us to add resources to sections as they become known.

Joanne Kehoe, Editor

May 2019

Educational Technology Sandbox Overview

Educational Technology Sandbox Concept

Support for the growth and expansion of technology-enabled learning and teaching is central to the mandate of eCampusOntario. In June 2017, eCampusOntario announced expressions of interest inviting its 45 member post-secondary institutions to participate in up to three different Educational Technology Sandboxes. The aim was to provide an opportunity to explore new tools to support technology-enabled learning in risk-free environments and across many spectrums. The three areas of exploration and their partner vendors were:

- Open badging (CanCred)
- Virtual lab simulations (Labster)
- Experiential learning (Riipen)

The pilot projects included face-to-face, blended, and online delivery in both undergraduate and graduate programs, as well as in professional and continuing education. They investigated the technologies' impact on the co-curricular record, faculty development, learner entrepreneurial initiatives, and mobile applications. Each institution set its own specific goals and terms of reference in collaboration with eCampusOntario.

Each sandbox period ran from September 1, 2017, until August 31, 2018, giving our institutional project leads a full year to use and evaluate the tool/platform. eCampusOntario supported project leads in collaboration with our partner vendors through orientation webinars, a Basecamp communication site, regular online clinics, and one-on-one online meetings.

The overall goal of these pilot projects was to generate a diverse collection of case studies based on the hands-on experiences of educators and learners at Ontario institutions. These case studies will be used to inform future decision making on potential shared services that will benefit Ontario's post-secondary education environment.

Open Badges

The Mozilla Foundation introduced Open Badges in 2011 as a transformational learning recognition and exchange standard. Badging is an electronic alternative framework for recognizing "life-wide" skills and achievements based on formal, non-formal, informal, and experiential learning. Open Badges contain a trail of detailed information about how they were obtained, providing their own auditable, digital provenance. Their modular and flexible nature supports agile approaches to learning and offer potential alignment to skills frameworks.

Open Badges act as highly mobile "records of learning" that can be transferred between technology systems that support the open standard. They can also be shared on social networking sites such as LinkedIn, which greatly extends their reach and potential impact.

The Open Badging Sandbox gave partner institutions the opportunity to explore how Open Badges can be employed as digital evidence of an accomplishment, particularly in the areas of:

- Alternative recognition of learning.
- Recognition of prior learning.
- Informal co-curricular learning.
- Skills and knowledge required for transition to work.

Eight CanCred Factory enterprise-level environments were made available through the eCampusOntario Educational Technology Sandbox, and each institution had access to a unique branded environment via the badge-issuing platform. Institutions succeeded in developing, issuing, and managing their own branded badges.

All badge data remains securely stored on Canadian servers that are compliant with the IMS Global Open Badge standard. A dedicated eCampusOntario Passport was also established as the common storage and display platform for Open Badges issued by the CanCred Factory environments. Badge earners were able to curate their badges in the Passport along with other evidence, such as documents, text, and embedded media using Apple's Pages which can function as micro-portfolios. eCampusOntario and the CanCred implementation team fully supported project leads in starting up their Factory environments and the dedicated Passport, and offered guidance in their badge system designs and implementation.

Virtual Lab Simulations (Labster)

Virtual simulations in the classroom provide additional access and opportunities for virtual learning experiences beyond physical boundaries. Labster has developed a suite of virtual laboratories and simulations modelled on real-world science lab experimentation and apparatus interactions. These simulations can better prepare learners for lab work by affording anytime virtual spaces for open-ended investigation and exploration.

Labster reports its use by institutions as a method of improving learning outcomes while reducing the costs associated with delivery, support, and maintenance of physical laboratories.[1] For many learners, access to lab space at Ontario college and university campuses is limited. The opportunity to access virtual spaces via Labster gives learners additional opportunities to prepare for lab assignments through self-directed experimentation, 3D animation, and real-time assessment.

Through its Educational Technology Sandbox, eCampusOntario obtained 1,100 individual learner licences from Labster for Ontario colleges and universities who wished run a pilot project to evaluate the platform in their science courses. Each licence granted the project leads and learners user access to the full suite of labs until August31, 2018. The project leads worked with the Labster implementation team to customize the educator/learner dashboards according to the goals and needs of each institution's project. (Currently, Labster simulations are available for biology, biochemistry, biomedical science, and chemistry-related subject areas. For the full list of simulations, see https://www.labster.com/simulations/.)

The Virtual Lab Simulations Sandbox gave institutions the opportunity to explore how Labster can support and extend technology-enhanced teaching and learning, particularly in the areas of:

- Simulation-based teaching.
- Access and virtual versus physical learning spaces.
- Experiential and experimental learning.
- Occupational standards.

Experiential Learning (Riipen)

In alignment with the report prepared by the Premier's Highly Skilled Workforce Expert Panel,

1. https://www.labster.com/why-choose-labster/

Building the Workforce of Tomorrow: A Shared Responsibility, the Experiential Learning Sandbox supported the provincial mandate to "ensure adult learners have access to quality experiential learning opportunities that are adaptable and appropriate to their needs."[2] While it is not feasible for every program or discipline to embed a co-op, internship, or practicum component, every student should be supported to develop real-world experiences and build employable skills. Faculty collaborating to redesign standard, in-class assignments into relevant industry projects, mentored by experts currently working in the field, extends the boundaries of current, often simulated, classroom experiential learning. Riipen was the chosen partner to equip and assist with this work-integrated learning option.

Riipen leverages any student-industry engagement (hackathons, case competitions, co-ops, internships, etc.) to provide meaningful data to schools and to industry partners on the verified skills and competencies of individual students. A popular use of the platform is to enable educators to easily transform their existing assignments into industry-recognized class projects.[3] The Riipen platform helps organizations and industry to connect, and to track project engagement, performance, and satisfaction.The eCampusOntario Educational Technology Sandbox provided three institutions with the opportunity to explore Riipen's experiential learning platform for student growth and employment preparation. Through this pilot, institutions had access to the following:

- An "educator module" with project management tools and real-time dashboard tracking engagement levels.
- An institution portal on Riipen's website as a central point of activity.
- Riipen's faculty success and customer success teams.
- In-house specialists to reframe in-class projects for the workplace.
- Canada-housed data on the project for review and analysis by the institution.

Educational Technology Sandbox Report Collection and Evaluation

Each institution participating in the Educational Technology Sandbox projects was required to submit three reports throughout the year: status, interim, and final. The status and interim reports provided

2. https://www.ontario.ca/page/building-workforce-tomorrow-shared-responsibility
3. https://www.riipen.com/learnmore/

valuable feedback and prompted additional support and guidance from eCampusOntario and partner vendors as needed before conclusion of the projects.

This publication is a synthesis of those reports, with the final reports providing the primary content. We felt it was important for the institutional voice to be retained, and therefore each case study is presented in the institution's own words, in its chosen narrative, with minimal editing for correctness and consistency. Each chapter presents a summary and a case study for each partner institution, including a set of lessons learned. Where the institutional case study mentions additional data or documents, they are included as appendices or links are provided.

OPEN BADGES: CANCRED

Key Findings: Open Badges

Open Badge Overview

"Open Badges are visual tokens of achievement, affiliation, authorization, or other trust relationship sharable across the web" (Discover Open Badges, 2018). These digital representations contain credentialling information, or metadata, based on an open technical standardized format created by the Mozilla Foundation in 2011 and currently managed by IMS Global. This metadata is determined by the badge creators and can include a badge name, links to a description and evidence, date of issue, criteria, issuer, issue date, expiration date, recipient, tags, alignment, and third-party endorsement. Open Badges can be easily shared in social and online networks and curated by the earner in a collection or portfolio for career, personal, and/or professional advancement. Open Badges represent one solution for individuals to aggregate learning achievements and associated evidence of learning from multiple sources in portable, digital, interoperable, and verifiable ways (Badge Alliance Endorsement Working Group, 2014).

Because Open Badges are relatively new, the research on their use within higher education is limited. However, case studies do exist that indicate one of the biggest obstacles to implementing badges as a form of recognition is the lack of perceived value by institutions and employers (Hickey, Willis, and Quick, 2015). However, a University Professional and Continuing Education Association (UPCEA) report based on data from 190 post-secondary institutions found that alternative recognition is rising in both value and popularity in non-traditional offerings and with non-traditional learners who need to share outcomes across their professional networks (Fong, Jangzow, and Peck, 2016). This finding is reflected in our badging evaluation reports as well, with badges having a greater value and uptake in non-credit faculty development and continuing education course implementation.

The eCampusOntario Educational Technology case studies involved badging explorations in professional development, faculty development, continuing education, credit and non-credit offerings, undergraduate graduate programs, and co-curricular experiences. Of these, more badges were issued by those institutions targeting continuing education, faculty development, and co-curricular experiences. For many other institution partners, the limited pilot period did not allow time to issue a large number of badges.

Summary of Badges Created, Issued, and Accepted

Participating institutions created badges that best represented their projects. Once potential earners submitted their evidence and a reviewer signed off on the demonstration of skills to fulfill the badge's

requirements, CanCred issued the badge through an email. Earners accepted the badge by clicking on a link and were then able to add it to their "backpack," post it on LinkedIn, or port it to other comparable systems. As administrators, eCampusOntario was able to track the process across its partners projects. Tables 1.1, 1.2, and 1.3 show the total badges created, issued, and accepted during the Sandbox Evaluation period.

Number of Unique Badges Created	Number of Badges Issued	Number of Badges Accepted	Badge Acceptance Rate
94	2 422	996	41%

Table 1.1: *Badges Created, Issued, and Accepted during Sandbox Evaluation Period*

Institution	Number of Unique Badges Created	Number of Badges Issued	Number of Badges Accepted	Badge Acceptance Rate
Durham College	5	568	380	67%
Fanshawe College	3	11	3	27%
Georgian College	11	84	59	70%
Loyalist College	7	5	0	0%
Ryerson University	8	1 275	244	19%
University of Waterloo	7	93	54	58%
Western University	15	205	118	58%
York University	7	36	5	14%

Table 1.2: *Badges Created, Issued and Accepted by Post-Secondary Education Partners Partners during Sandbox Evaluation Period*

Number of Unique Badges Created	Number of Badges Issued	Number of Badges Accepted	Badge Acceptance Rate
31	145	133	92%

Table 1.3: *Badges Created, Issued, Accepted by eCampusOntario during Sandbox Evaluation Period.*

Table 1.1 shows an overall badge acceptance rate of 41%. Two of the highest acceptance rates were from Durham College and Georgian College. Both those partners indicated that they created a robust orientation to what badges are, which may have contributed to this success. In particular, Georgian College's badge implementation was geared toward its faculty development program, with badges being awarded not only for this program, but also described as potential recognition for faculty as learners. Georgian College notes in its report that the badges were issued to colleagues who already have an established relationship with the Teaching and Learning Centre, which likely

explains the higher-than-average acceptance rate. Durham College issued its badges within non-credit continuing education programming; anecdotal feedback was that learners were anxious to receive recognition of their badges to share on social media and LinkedIn.

The Value of Badges for Earners, Educators, and Employers

The overall level of uptake on badges issued indicates that earners are not fully aware of what these alternative forms of recognition represent. Survey results from one of our partners, Ryerson University, verified this theory, with a large number of badge earners (whether they accepted the badge or not) reporting that they were unclear about what a badge was. This feedback indicates the need for strong orientation to the value and the portability of Open Badges. A great tip by one partner institution was to include a linked resource on what a badge is and what it can represent as part of the badge-issuing message.

Educators also indicated being uncertain about the value of badges and how they could effectively use them in their teaching. Clearly, training and orientation for educators are key. An interesting two-pronged approach by Georgian College involved awarding badges as part of its faculty development program, as mentioned above, with the result of educators understanding the potential of Open Badges and subsequently exploring how they could integrate them into their teaching. A similar approach was suggested with institutional staff development—starting small could pique interest and spread information well before badges are integrated into academic and co-curricular programming.

A number of open badging pilots involved employer input and perspectives. Durham College reported that employers initially perceived badges to have little value; however, after learning what badges can represent, these employers urged their continuing education unit to use badging in future courses. A key recommendation from many partners was to include the Program Advisory Committee (PAC) in the development of badging systems, as these groups typically include employer and industry representatives.

Sandbox partners also considered the availability and value of the "badging endorsement" feature, which would enable any organization to endorse another organization's badges. This feature, however, was only added to the CanCred Factory platform and presented to institutional partners two-thirds of the way into the pilot, which was too late for institutions to incorporate it into their projects. At the time, this additional feature was deemed to be a way of increasing badge credibility and creating strong partnership networks. Even though it was not used during the pilot, plans for industry and institutional endorsement of the feature are being considered for the future.

Badging Teams

The pilot evaluation period was a good opportunity to better understand what people need to be involved in the development of a robust badging system. All of our partners provided information on the staffing needs internal to the institution, and some mentioned what external perspectives were, and would be, valuable.

Many institution partners recommended that all members of the badging team have a good understanding of the value of open badges in addition to the process by which they are created, earned, issued, and shared. Clearly, having a badge orientation process for developers is a critical component of any project plan.

Internal badging teams emphasized a collaborative approach, with critical roles and various levels of participation from teaching and learning professions, information-technology professionals, learners, alumni, and external stakeholders who would have an interest in recognizing and endorsing the skills represented by the badge. Another recommendation was that this approach should be formalized by establishing a badging project steering group whose mandate would include a needs analysis, project oversight and management, and a communication plan that incorporates a regular reporting mechanism to academic leadership.

The involvement of the institutional branding office was also mentioned as a key step in establishing a badging system, depending on the culture of the institution. The visual design of a badge is reflective of the institution, whose brand and guidelines should be incorporated from the outset. Currently, retroactive application of design to badges that may have already been issued is problematic.

Partner institutions reported a need to ensure that any badge orientation process—for educators, for students, and for employers—be targeted to key stakeholders. They recommended integrating conversations about badges into PAC meetings as a method of increasing stakeholder engagement and understanding of how badges can benefit learners in the program.

Badge System Structure

The badges developed during the pilot were mainly linear in nature, with a couple of exceptions. Although Loyalist College did not issue any badges, the team developed a levelled co-curricular badge system that aligned with four tenets: learning, community, leadership, and self-reporting. The plan is for levelled badges to be awarded based on a points system: bronze star (100 points), silver star (200 points), and gold star (300 points). Fanshawe College also developed badging plans that clustered courses around a milestone achievement.

Badges were issued either automatically or after review of an application. Those that issued

automatically were generally to earners who passed or completed a shorter, workshop-type learning experience. In these cases, the badges were issued by email. Those awarded upon application required the badging team to create the application steps in CanCred Factory and direct the learners to complete the form via an email link.

During the pilot process, institutions noted that conversations occurred concerning the creation of a shared badging taxonomy. A badging taxonomy fleshes out the potential uses and classifications of badges and provides a visual representation of similarities, differences, and connections across an institution's badging system. Developing a shared badge taxonomy involves imposing consistent branded shapes or icons that may demonstrate rigour; having visual signifiers (e.g., colour, font, second shapes along perimeter) if the badges are part of a collection; and using a naming and issuing protocol.

A general discussion about the potential of a shared taxonomy was held by institution partners during an open badging webinar. Badge taxonomy resources were shared with and distributed through Basecamp. The badge taxonomy example from Mount Vernon Institute for Innovation was viewed as a helpful guide.

One sandbox partner, Georgian College, tied its badges to an existing framework: the Quality Matters Course Design Rubric. This framework was enabled by the "alignments" feature in CanCred Factory, which allows users to create or add their own frameworks to apply to their badges. Institutions engaged in the pilot agreed that the decision to align badges to existing standards and competencies can build credibility within the post-secondary education community and increase recognition of badges further afield. To this end, institutions in the pilot discussed using existing frameworks for employability skills (e.g., the Ontario Essential Employability Skills Framework) in connection with institutional objectives and graduate attributes (i.e., institutional learning outcomes).

User Experience

Feedback from project teams indicate that the CanCred platform is easy to use and that creating, designing, and issuing badges is fairly straightforward. Partners found that reports were easy to generate and functionality was intuitive and well designed. Two significant technical issues mentioned were the need to integrate with various learning management systems (LMS) and the difficulty in sharing badges on LinkedIn.

LMS integration was reported as the most logical solution for sustainability of any badging system. As this was not available for this pilot period, users developed a workaround with help from CanCred. However, this solution resulted in more steps, both for issuing the badge and for earners claiming the badge. At the time of this report, CanCred was close to completing the integration with Desire2Learn (D2L), which holds the biggest share of LMS use among Ontario post-secondary institutions.

Badge earners also reported challenges in trying to receive a badge, move it from an institution's LMS to eCampusPassport, and then display it on LinkedIn. They reported there being too many steps, and many students eventually gave up, despite there being available documentation and guidance. Students suggested including a real-time online chat function site of support.

During the pilot period, LinkedIn changed how certifications are displayed on their web platforms. This resulted in a more manual process to add a badge to a user profile. CanCred Badge Factory provided sandbox partners with information on how to navigate this new process.

As part of their pilot project, the University of Waterloo also developed a tutorial on how to claim and share badges.

Other Challenges

In addition to the challenges mentioned above related to value statements, LMS integration, and sharing badges on LinkedIn, there were other "pain points" disclosed in the reports, which should be considered by those exploring the implementation of a badging system.

The main challenge is the additional work needed to develop a robust badging system. For many in the sandbox, this project was added to an already heavy workload, and many did not have time to make it a success. The technical, infrastructure, and human resources required to support implementation of a badging process are critical to ensure widespread understanding, endorsement, and adoption.

Another challenge highlighted as significant was the manual review process of badge applications. Such a review is needed to ensure that an earner has met all of the criteria and to uphold the quality and credibility of a badge. However, the time-intensive review process may be a barrier to widespread adoption by institutions. In response, some institutions considered implementing a peer review process, and awarding a "badge reviewer" badge to those learners (and earners) who qualify to review their peers' work. However, at this early stage, it is paramount that the time needed to properly manage the badge application process is incorporated fairly into the job responsibilities of an individual or team. Doing this early on will improve chances of building a sustainable badging system.

Also noted was the time required to identify the key stakeholders both within and outside an institution. These key stakeholders are essential to establishing a working group early in the implementation of a badging system. When establishing working groups, institutions found that significant time was required to connect with representative stakeholders. When approaching stakeholders to participate in a badging project, leaders should be careful to accurately articulate the scope of involvement and time commitment required.

Finally, another hurdle of this pilot project was the five-week work stoppage throughout the Ontario college system during the first half of the evaluation period. During the fall of 2017, instructors were unavailable to participate in implementing badges in a meaningful way, and college staffing resources were compromised because of the strike.

Future Plans

Many of the sandbox partners have chosen to continue with their badging explorations. Those who have invested significant time to plan and/or pilot a small badging system feel that the work they have already completed provided a good introduction and set the stage for future success.

Future plans include additional badging within continuing education, faculty/professional development programs, and co-curricular activities. These plans are contingent upon integration with LMS as well as existing co-curricular student record systems. Partners specified plans to leverage existing partnerships with employers and obtain feedback from graduates entering the workforce to ensure that both curricular and co-curricular badges address skills needed, skills gaps identified, and new opportunities.

Some partners plan to create an online module that will be integrated into their LMS in order to build awareness of badges, their value, and potential incorporation into curriculum. This module could be turned on for courses that include badges.

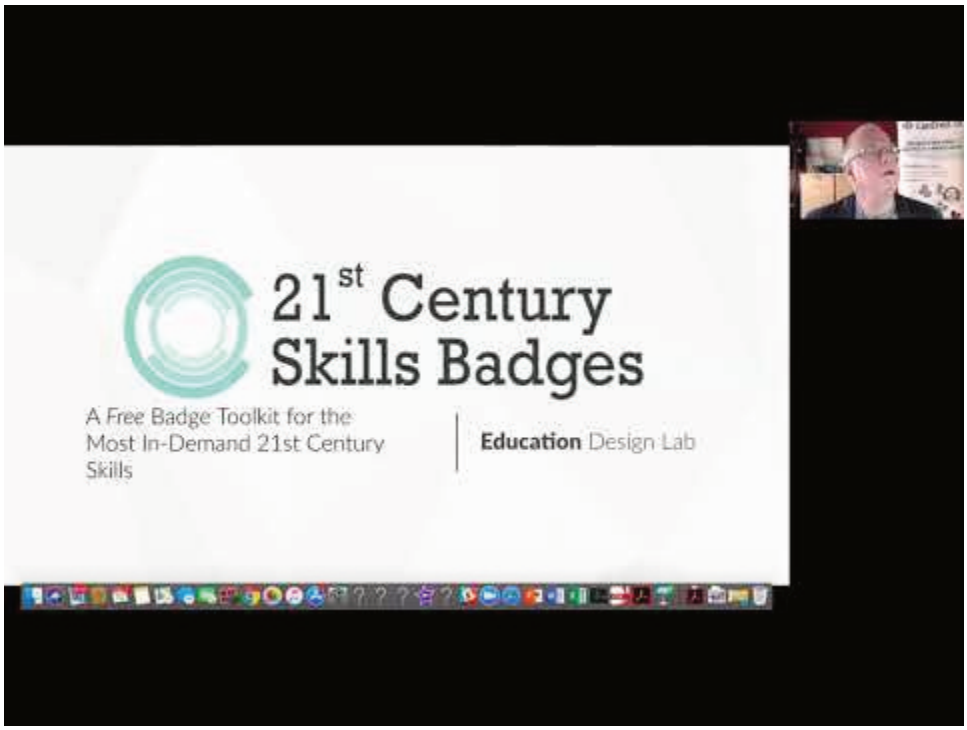
As noted, endorsements will continue to be an area of great interest and a source of exploration for our partners. Third-party validation of a badge is viewed not only as a value-added opportunity to build credibility and create meaningful badge ecosystems, but also to help strengthen and grow existing collaborations. It is important to note that endorsements can be more formal (e.g., tied to an accreditation) or informal (e.g., meets with our approval or guiding principles and purpose). For further reading on the potential of endorsements, we recommended CanCred's post by Don Presant to our partners .

The value of badges as prior learning assessment, particularly for the growing international student population, was also earmarked as an area of future exploration.

Support

A common thread among all the sandbox partners was that the support offered by CanCred and eCampusOntario was highly valued. Because there was a wide range of teams and varying levels of open badging awareness, the two organizations provided both group and one-on-one orientation webinars in addition to shared monthly badging clinics. The clinics provided a combination of

onboarding and/or a tour of additional features added to the platform with featured speakers from well-established and recognized badging systems worldwide. The clinics were recorded and are available from the following playlist:



A YouTube element has been excluded from this version of the text. You can view it online here: https://ecampusontario.pressbooks.pub/edtechsandbox/?p=5

In addition, a Basecamp community was created to facilitate communication and sharing of documents and other resources. As awareness of the open badging sandbox pilot grew, we received interest from other Ontario post-secondary institutions. Individuals from additional institutions that had pursued CanCred Factory accounts outside of the sandbox project also joined our Basecamp, which grew to be a total of 31 members. This communication platform will continue after the conclusion of the project to foster conversations and development of open badging systems in Ontario. Anyone is welcome to join by contacting projects@ecampusontario.ca.

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Durham College

Project Description

The primary goals of the project were as follows:

- To test the perceived value of badges among students taking professional development courses (status: completed).
- To test the perceived value among employers of badges related to professional development (status: limited completion).

Our original vision of the project was to grant badges for the following courses:

- Medical Cannabis Fundamentals for Business Professionals (two-day in-class and concurrent synchronous online course).
- Advancing Your Negotiation Skills (five-hour synchronous online course).

We had hoped to also issue badges for two other courses: Handling Office Conflict and Giving and Receiving Feedback (both of which were five-hour synchronous online courses), but neither course ran due to inadequate enrolment levels. Had these courses run successfully, we had a milestone badge available for students who completed both the Advancing Your Negotiation Skills and the Handling Office Conflict and Feedback courses. However, this badge was not awarded because two of the three courses did not run despite offering them multiple times.

Overall, we consider the project a success. In total, 403 badges were issued to students in the cannabis course, 269 of which were accepted (67%). For the negotiation skills course, 42 badges were issued, 30 of which were accepted (71%). Student surveys provided anecdotal feedback indicating that badges were considered valuable (even though quite a few students initially said they were not sure what badges were). Anecdotal employer feedback indicated that seeing a badge included on a LinkedIn site or resumé gave credibility to the job applicant.

Badging Team Description

The dean of the School of Continuing Education led the badging project throughout its duration. Instructors who delivered the courses were provided with information about what badges were and the process through which students would receive them. (This was important because it was the instructors who communicated directly with the student recipients.) The dean and instructors

communicated both verbally and via email. Students were told about the badges during their courses (i.e., verbally). Of course, they received their badges via emails that included detailed instructions on how to load them into LinkedIn.

Anecdotal feedback from employers was gathered during a Program Advisory Committee (PAC) meeting on the cannabis industry in July 2018. Industry members were very enthusiastic about the approach of badging courses and strongly urged that future courses be badged as well. We have subsequently decided to badge all six courses in the new Cannabis Industry Specialization program, so that if students decide to take only a few courses in the program, they will still have something to show prospective employers.

Badging System Structure

Medical Cannabis Fundamentals for Business Professionals

Criteria

Recipients of this badge successfully completed an intensive two-day course (attended either in-class or synchronously online) on medical cannabis in Canada. Through the course, the badge recipients developed familiarity with the history and emerging trends relating to medical cannabis in Canada, established an understanding of key industry terminology, examined various ethical and clinical concepts, gained a basic understanding of cannabis cultivation and quality controls, learned about insurance as it relates to the industry, acquired insights into customer/patient issues, and explored industry-related marketing and communication principles.

Assessment

In order to earn this badge, students had to attend both days of a two-day course, complete all in-class learning activities, and pass two written quizzes. Instructors kept attendance records as well as checklists of activity participation and copies of the completed quizzes to confirm that students had passed.

Advancing Your Negotiation Skills

Criteria

Recipients of this badge actively participated in all five one-hour course sessions (delivered synchronously each day). After each session, the recipients submitted work that demonstrated their ability to apply their learning to an actual negotiation situation. The specific competencies demonstrated by the recipients in this courses included relationship building, communication, influencing, and planning.

Assessment

In order to assess these competencies, participants were required to prepare and submit the following work to the instructor after each one-hour session:

- **Module 1:** Identify a real-world upcoming negotiation to be used for the application of course learning. Identify the top three skills/tips/strategies to be implemented based on learning from session 1.
- **Module 2:** Complete the Needs and Interests Inventory (as it relates to the real-world negotiation selected after Module 1). Identify the toughest questions and power types expected in the negotiation. Identity someone who can assist in a role-play negotiation.
- **Module 3:** Complete the planning worksheet for both sides of a negotiation case study (case provided by the instructor). Complete a Negotiation and Collaboration Worksheet for the real-world negotiation.
- **Module 4:** Conduct the role-play negotiation and report back on results. Complete the Solution Choice Design Worksheet for the real-world negotiation.
- **Module 5:** Complete the Negotiation Self-Assessment Sheet to identify strengths and areas for continued development.

Participants had to submit all of the above pieces of work for review by the instructor (who provided follow-up feedback at the individual level) in order to qualify for the badge. There are quite a few instances in which the instructor provided feedback that required an individual to rethink and resubmit their work for a given module in order to demonstrate a given competency. It is also important to note that not every student fulfilled the requirements to receive a badge. Missing even one piece of work or one session meant that the individual did not receive a badge for the course.

User Experience

In total (and excluding badges issued during our testing phase), we issued 445 badges under this project. Given that 299 students actually accessed their badges, it would be appropriate to say that this was the number of students using the platform. In addition, four other people used the platform on an administrative basis (i.e., issuing badges). The cannabis course ran at least monthly (more recently, twice per month), so the platform was typically accessed at least several times each month.

The most significant technical issues related to students having difficulty following instructions on how to retrieve their badges. We provided clear documentation on how to do this, but because there were numerous steps involved, some individuals simply gave up and did not bother to retrieve their badges.

Overall, the platform was relatively easy to use for those handling administrative tasks. When they did

run into problems, they asked the dean for help. If the dean could not solve the problem, the issue was escalated to CanCred. Generally, problems were resolved in a timely manner (although, having an online chat function to get immediate assistance would have been valuable).

Value

Paper-based surveys were conducted with the students in the cannabis course. Unfortunately, due to severe resource constraints, those results have not been tabulated electronically. The dean reviews each set of course surveys personally and has spoken directly with approximately 50 students to ask about their perceptions of the badges, so she has a very good understanding of how students feel about them. It is her knowledge that has been reflected in this report.

Challenges

It will be very important to begin using the endorsement feature of badging as soon as possible, as this recognition from employers will have a significant effect on student perceptions on the value of badging.

It is unlikely that badging for academic purposes will be adopted in the Durham College schools outside Continuing Education because the other academic schools run full-time post-secondary programs in which successful completions are marked with diplomas. However, there has been some preliminary discussion about the possibility of introducing badging to recognize faculty accomplishments. It is likely that Continuing Education will pilot this when it introduces quarterly synchronous professional development sessions. This will serve as yet another pilot because it will give us an indication of how receptive faculty might be to the use of badges to recognize their developmental activities at a broader level across the college.

Future Plans

In the upcoming PAC meeting on the cannabis industry, members will be asked if they would be willing to endorse the cannabis course (soon to be courses). We will continue to monitor acceptance rates of our badges to ensure that the financial investment required to continue offering them is worthwhile.

Lessons Learned

Lessons Learned

- Communication with students to explain the value of badges is essential. This is not something that needs to be done once, but rather, it needs to be discussed at least several times during a course, beginning at the outset.
- Badging is best used with short courses, rather than longer courses that are part of a larger credential. Students are very keen to receive some type of recognition for finishing a single course, and badges are an excellent solution for this.
- Do not underestimate the amount of administrative work needed to issue the badges. While the process itself is not difficult, a resource is required after a course is completed to compile information on attendance, quiz completions, etc. to confirm that a given individual is eligible to receive a badge, and to manually enter email addresses into CanCred Factory. Support must also be available for a least a week following a given course to answer student questions about their badges.

Fanshawe College

Project Description

Fanshawe College considered three unique projects for their open badging exploration:

- **Project 1**: Lisa Wells, program manager–Woodstock Campus
- **Project 2**: Candace Miller, program manager, Lawrence Kinlin School of Business
- **Project 3**: Jessica Bugorski, chair, School of Language and Liberal Studies (SLLS)

Project 1
The Woodstock Campus is developing badges for non-credit offerings. So far we have approached the Oxford Workforce Development Partnership and the Local Training Board to support our initiative. Both agencies have endorsed our project. We have selected several workshops to be part of our project. These workshops include Customer Service Training, Word, and Excel.

Project 2
The primary goal of our project is to develop badges for credit courses taken through part-time studies in business. Upon completion of four courses/badges, the participant is eligible for the Digital Marketing milestone badge. Badges are being used as "just-in-time" recognition for participants and helps motivate them to continue to work toward a milestone goal.

Project 3
SLLS's aim is to augment the academic credentials in two fully online graduate certificate programs: Advanced Communication for Professionals (ADC1) and Research and Evaluation (RES1). Each badge issued in the proposed programs recognized the successful completion of the learning objectives of a course, a thematic grouping of courses, and/or a program as defined by Fanshawe College, Ontario College Quality Assurance Service (OCQAS), and the Ministry of Training, Colleges and Universities (MTCU).

The project was a partial success in that it gave three academic departments of the college the opportunity to discuss badging as a future direction and consider under what circumstances they would issue badges, and to examine the CanCred platform. In addition, our Reputation and Brand Management department designed the badges (their appearance). Information Technology (IT) Services investigated what system supports would be needed to issue badges.

The project was not a complete success in that we did not implement badges due to not having a way to integrate the issuance of badges with our learning management system (LMS) or our student information system. Representatives of our IT Services department discussed this situation with

CanCred. This issue was also communicated to eCampusOntario. We are still on hold pending more information about functionality that may be added to the LMS.

Badging Team Description

Three academic managers from three different departments were involved. They worked individually or with another person.

Prior to starting the project, the subject of badges had been discussed with advisory committees and received support.

During the project, meetings were held with other internal departments, including the Office of the Registrar, IT Services, and Reputation and Brand Management. Each of these departments provided questions, opinions, and caveats, and conducted some further work as mentioned above. As noted, IT Services also consulted with CanCred.

Because of the implementation issues described above, we have not brought the discussion back to advisory committees.

Badging System Structure

No badges were created or issued for the reasons described above. Only visual mockups were created.

The three groups involved at Fanshawe settled on the following three reasons why badges were to be issued, based on three different levels we devised:

- For the successful completion of a workshop (i.e., one-day workshop).
- For the successful completion of a credit course.
- For the successful completion of a cluster of courses.

Each level was to have a different badge with a slightly different appearance for each. The three departments had identified pilots but could not proceed.

User Experience

There were few users testing the CanCred Platform in our pilot. Support was provided by Learning Systems Services (a department within IT Services) at the college as well as through the open

badging forum/sandbox from eCampusOntario—these were very helpful. In SLLS, the e-learning coordinator and the educational support technologist explored the basic user interface of the system and its feasibility with little difficulty, but by the end of the pilot, an LMS integration for auto-generated badging became the most logical solution for sustainability. Because there were integration difficulties that arose with our LMS upgrade (which occurred half-way through the pilot), no further testing was conducted in LSS with CanCred.

No training or orientation procedures were developed.

Value

As indicated above, because we were unsuccessful in issuing badges during the pilot, any planned data from earners and consumers as outlined in our original proposal was not undertaken.

Challenges

To reiterate, the manual issuing of badging was the biggest factor hindering the widespread adoption within our institution. Questions arose as to who would be responsible for monitoring the process on an ongoing basis: the coordinator of the program, an educational technologist, support staff, or faculty themselves? What additional workload assignment was needed going forward?

Lack of a stable LMS integration and a cost for licensing both the integration from the LMS developers and CanCred are also key factors against widespread adoption. Without a seamless transition between course completion and badge issuance, a manual process would also add additional workload to the registrar's office, if there was widespread adoption.

Future Plans

Discussions will continue within the college as a whole to explore a more sustainable and manageable solution to the potential of offering badging and alternative micro-credentials. Rather than focusing on credit-based courses, discussions continue on the value of badging for in-house professional development and non-credit opportunities for students at the college. Integration with the college's co-curricular record system for acknowledging student participation and experience while in college may also be an easier way to gauge student interest. With an increase of international student enrolment, the value of a badging system and its transferability in other cultures will also need to

be reviewed. Overall, however, an in-house badging system (not a third-party developer's product) would seem more appropriate for longevity and sustainability.

Lessons Learned

Lessons Learned

- Establish a working group early in the process with representative stakeholders to avoid delays and anticipate the scope of involvement and buy-in within the organization.
- Determine early on the appropriate method of issuing badges for sustainability.
- Choose the right set of courses/programs for badge issuing and conduct external stakeholders/ employee groups before commencement to determine interest and potential value.

Georgian College

Project Description

Our open badging project introduced digital badging to enhance professional development credentialling programs at Georgian College. Currently, the Centre for Teaching and Learning (CTL) at Georgian College celebrates the achievements of new and experienced faculty and provides motivation to participate in ongoing professional learning by offering both a teaching practice credential (TPC) and recertification opportunities. One of our goals was to provide exposure to the use of digital badges in CTL workshops and enable opportunities for faculty to consider how micro-credentialling can be used to enhance learning within their own programs of study and grow the use of digital badges within the institution. This additional outcome aligns with the institutional strategic goal to empower faculty to select and use a variety of technologies in the classroom. Our vision was to offer a series of micro-credentials and motivators for faculty by tying digital badges to specific pedagogical competencies.

We tied digital badging to the Learning Online to Teach Online (LOTTO) program, which is a contributing component to achieve the TPC or recertification. LOTTO has been designed for teachers who are interested in learning how to teach effectively in an online learning environment and was an excellent choice for this project because it is tied to a framework for quality assurance (Quality Matters). It is regularly delivered online asynchronously (twice per semester, three semesters per year), which provides many opportunities for a large number of faculty to participate in the program.

We consider our project a success. We had several faculty complete the modules and claim their badges. Many of those faculty have expressed interest in designing their own digital badging system, and we will be working with them to do that in the coming months.

Badging Team Description

Our team consisted of myself (Alissa Bigelow, Instructional Design Technologist) and Amy Goruk, Instructional Designer. Although we were a small group, we were able to fulfill the needs of the project and ensure everything was set up for success each semester.

LOTTO is delivered in a fully asynchronous format and we did not interact with our learners directly. Instead, we communicated through email and our learning management system (LMS), Blackboard. An introduction to the project was included in the first week's email. A reminder announcement about the project was posted in Blackboard during week 3 and at the midway point, and a final reminder

was communicated in the week 6 announcements and closure email. Our learners were also our colleagues so we were able to gain some valuable feedback from them as the project progressed. Due to the nature of our project, we did not communicate with employers or other stakeholders.

Badging System Structure

Learners participating in LOTTO had the opportunity to earn seven digital badges throughout the six-week program: Newbie, Communications Champ, Multimedia Madness, Planning Prodigy, Ready to Launch, Tying It All Together, and after earning those first six, the Guru badge. Over the course of the project, we had 44 people enroll in LOTTO with 33 completing all six weeks. The following lists how the total of 78 badges were earned:

- 43 individual badges:
    - Newbie – 11
    - Communications Champ – 9
    - Multimedia Madness – 7
    - Planning Prodigy – 5
    - Ready to Launch – 6
    - Tying It All Together – 5
- 5 Guru badges (representing 35 badges in total to these earners)

Our badging project helped the faculty participating in the LOTTO program develop various digital competencies as outlined by the NC Digital Learning Competencies for Educators:

- Leadership in Digital Learning: Faculty learn how to integrate digital teaching and learning pedagogies.
- Digital Citizenship: Engage in responsible and professional digital social interaction.
- Digital Content and Instruction: Learn how to select and use digital tools and resources for instruction.
- Data and Assessment: Use technology to make data more accessible, adjust instruction to meet the needs of a diverse learning population, and reflect upon their practice through consistent and effective assessment.

These competencies were achieved by completing tasks in each module and sharing with the rest of the group. A variety of digital tools were used to demonstrate the competencies and included using tools such as discussion boards, screencasts and videos, wikis, a blog, and online quizzes.

Our badge system is currently linear because we wanted to keep it relatively basic for the pilot. We plan to expand digital badging into our TPC programs. As we expand, we expect the linear nature

to evolve as some of the badges earned in LOTTO can be applied or transferred and integrated with programs in the TPC.

User Experience

I was not aware others could use the platform so I was the only one with access. I used the platform a few times each semester to monitor the progress of the pilot. Overall I found the platform to be relatively easy to use. The forms that were required to be completed for each stage of the badge creation process were straightforward, and the numbered progression from step to step to guide issuers was nice. We experienced some technical issues between the platform and our LMS and unfortunately had to use a workaround method that contained more steps for our earners to claim the badges. CanCred was fantastic to work with throughout the entire project. Don Presant was able to connect us directly to the technical team and was in constant communication throughout the whole process.

Value

We received some good data about learners and those who claimed badges from the CanCred platform. Unfortunately, during initial testing I neglected to check a box that would exclude my badge from the live system so some of our numbers are a bit skewed. The platform does not provide the ability to delete users from the system, so there was no way for me to clear my badges from the reports.

We also developed a Google form to gather feedback from our learners. Initially we had an adaptive release setup so the form appeared once the learners claimed their week 6 badge. However, we found that we wanted feedback from those who did not participate in claiming the badges as well, so we changed the delivery of the feedback form to be embedded for everyone in the badging area of the LOTTO course shell in our LMS and encouraged everyone to complete it. Understanding why some didn't participate is also very valuable information.

The results of this project will be included in the Board of Governors report and publicized via our internal news portal. Participants were encouraged to complete this feedback form:

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=31

Challenges

A significant challenge we encountered was that there were too many steps for the learners to get the badge from our LMS to the eCampusOntario portal and then to LinkedIn, which we found was the drawing factor for many who participated. The learners had to click the link to the badge application from within our LMS which took them to the badge application form in the CanCred platform. In order to claim the badge they had to click a link in the confirmation email they received from CanCred and then proceed to getting the badges into the eCampusOntario badging portal which included having to create an account and then load the badges. Even though extensive documentation and support was provided (including a screencast tutorial), this process was not straightforward and deterred some learners from claiming the badges. Unless there is a smoother transition from our LMS to the eCampusOntario portal, the opportunity to grow badging within the institution will suffer.

Another sticking point was an issue between CanCred and LinkedIn in which the badge images will not display to showcase the badges in LinkedIn; instead the college logo is displayed.

Future Plans

Our Vice President Academic has approved extended access to the CanCred platform for an additional year in an effort to grow digital badging within the institution. The CTL is currently offering a badging e-learning module within our LMS. Members of the CTL team are directing people who are interested in learning more to this module and to me for one-on-one support. We are planning to meet in the near future to determine goals and how to grow this initiative.

The amount of support we will need in the coming year will be determined by the uptake. We will definitely need to work with CanCred to figure out a smoother way to issue badges to learners and how we can get more accurate reporting data, as I can foresee new badge issuers will also accidentally neglect to exclude themselves during the testing process.

Lessons Learned

Lessons Learned

- Determine the competencies you wish to badge before you begin.

- Be sure to select a program/course/professional development suitable for badging.
- Ensure you will be able to provide a smooth transition between earning, claiming, and sharing the badges.

Loyalist College

Project Description

Original Goals: This initiative will explore using the CanCred platform to capture competencies and skills that students gain outside of the classroom – through volunteering, workshops, self-study, and workplace experiences – in co-curricular badges that can be used as evidence of employability skills in action. Current students and past graduates will be able to use these badges in existing resumes and/or digital portfolios – and in a centrally developed transcript – to highlight achievements in 6 areas of institutional focus. By aligning initial badge offerings to institutional objectives and engaging with on-campus specialists and community partners, the project will have full institutional support.

The goals and vision of the badge system have not changed from the initial project goals. Yes, we consider our project a success. The project provided structure to establish a project steering group. Accomplishments included conducting research in co-curricular badging with other Post Secondary Education Institutions in Canada and the US, and experiencing the CanCred platform through the creation and testing of badges.

Badging Team Description

The project steering group included Christine Eddy, Manager, Centre for the Advancement of Teaching & Learning; Paul D. Smith, consultant; Lyndsay Kerik, senior career and alumni services officer; and Julie Sullivan, distance education development analyst. The project plan had been presented and approved by the academic leadership team.

The project team created a badging survey and conducted research with other post-secondary education institutions in Canada and the United States on their use of badging, identifying successes and challenges.

Three members of the project team attended and networked with attendees of the eCampusOntario Open Badging Forum on November 22, 2017. Steering group members attended and participated in eCampusOntario badging clinics. Following a clinic we had a subsequent virtual meeting with Jeff King and Brenton Wimmer, University of Central Oklahoma, regarding their Student Transformative Learning Record (STLR) and specifically STLR Employer Advisory Boards.

Members of the project team have met with Brad Labadie from the East Central Ontario Training Board to review the local Employer One Survey and discuss community partnership. Additionally, the

Loyalist Career Centre is acting as a consultant, leveraging its partnerships with local employers and feedback collected from graduates entering the workforce to ensure co-curricular badges address in-demand skills, skills gaps, or emerging opportunities.

Badging System Structure

The distance education analyst partnered with the senior career services advisor to draft two co-curricular scenarios, leveraging our Loyalist Shield Health and Wellness initiative and student government scaffolding. The analyst accessed CanCred and created additional sub-organizations and additional badges, and issued badges for testing purposes.

The Health and Wellness program was identified as a viable test area for initial co-curricular badges.

Competencies include a demonstrated ability to manage one's own personal health, wellness, and stress. Three levels of badging would be attainable:

- Bronze Star: Health and Wellness–100 points from the four tenets.
- Silver Star: Health and Wellness–200 points from the four tenets.
- Gold Star: Health and Wellness–300 points from the four tenets.

The four tenets are learning, community, leadership, and self-reporting.

Students gain the competencies outside of the classroom through volunteering, workshops, self-study, and workplace experiences. Example activities might include placement completed in a wellness-related field, such as being a captain of an intramural team, a volunteer orientation leader, or a leader of a wellness ambassador team; being active on an athletics support team, in residence life role, in a campus recreation role, as a member of community wellness club, or a community event leader; attending a community event attendance; using the fitness facility; participating in a campus recreation activity or in residence life activity session, etc.

User Experience

Two staff accessed and tested the CanCred Factory platform during the pilot. We used the platform intermittently. We liked the ability to design the badge, create sub-organizations, and issue the badge. We felt the format of the email to communicate the badge issuance was effective.

Technical issues during internal testing occurred when we recognized server issues due to internal email settings at Loyalist.

The badging clinics, Basecamp site, and shared badging resources were very helpful for researching the badging landscape. Response to technical questions was very timely and helpful.

The eCampusOntario Open Badging Forum on November 22, 2017, was a great opportunity to learn from employers and community partners offering insight and networking opportunities.

Value

We have issued badges for testing purposes so have not yet gathered evaluative data other than that collected for those tests.

Challenges

One of the challenges internally is resourcing the technical resources and infrastructure to support implementation of the badging system goals. Additionally, we need to ensure the focus is on the real purpose of the badge and not lost in the design and graphics phase.

Externally, students may not leverage their co-curricular record and use the language of learning outcomes to enhance their skill articulation and showcase their diverse array of skills. Lack of the students' use/ability in articulating outcomes may affect the perceived value of the badge/co-curricular record by employers.

Future Plans

Our project is at the milestone of investing further in exploring graduate attributes and badging. The mandate of the graduate attributes coordinator (GAC) is to develop Loyalist College's framework for graduate attributes designed to ensure that graduates possess specific attributes to prepare them for work and life. The GAC understands the national landscape of experiential learning, including co-curricular record, portfolio development, career education employability skills, and measurements (specifically badging). The context of these attributes will be embedded in curriculum, applied to the further development of our programs, and developed through meaningful experiences and the process of learning and reflection outside of the classroom environment.

By aligning initial badge offerings to institutional objectives and engaging with on-campus specialists and community partners, the project will have full institutional support. Partnering with local employers and the local training board will inform the badging system implementation.

Lessons Learned

Lessons Learned

Badges are an emerging platform that are understood by a marginal number of employers and a larger, but still limited, number of educators. We are in the early stages of adoption of the technology.

- Be optimistic about the potential of badges, but temper your expectations with realism. Badges have the potential to change the labour market, but a great deal of promotional groundwork needs to be done.
- Be patient with badges. We are in the shaking-out phase, and it is likely that we will see multiple false starts, with solutions emerging as dominant, and then falling back. Think programming languages, or VCRs.
- Be prudent with your planning. Build your badging program slowly, working with projects on the edges of your operation, such as staff PD or a selection of distance education courses. Make sure your badge initiative is robust before attempting to integrate it with core academic offerings.

Ryerson University

Project Description

Original Goals:

1. To provide students with a tool for validation for achieving core, intermediate, and advanced levels of seven overarching development themes, including collaboration, communication, community engagement, innovation and problem solving, leadership, personal management and responsibility, and storytelling with research and data.
2. To enable students to showcase their achievements and skill development on social networks through badge distribution.
3. To encourage students to use their e-portfolio as a means of reflection and application for badges.

Our goals were forced to change over the course of the project due to the inability of CanCred to integrate into our learning management system, Desire2Learn (D2L). With the shortened timeline, the scale of our badging process was reduced. We changed the badging process from one based on very specific skill development to one based on completion of workshops and courses. Our original plan was to just badge within the Student Life department, but after a few conversations with our Learning and Teaching Office, we expanded to include two of their courses as well.

We consider this project a partial success. We were able to try out a badging program and process, as well as assess whether the distribution of badges provided an incentive to students on a small scale. While the D2L integration issues were limiting, we were still able to carry out the project.

Badging Team Description

Collaborators/partners involved in this project include:

- Student Life
- Learning and Teaching Office (LTO)
- Digital Media Projects

Communication and collaboration across these three areas mentioned were consistent, clear, and ongoing. Badges were distributed by both Student Life and the LTO. Similar communication in terms

of the value of badges was provided across both areas. Instructions provided to students for accepting the badges were consistent across both areas and were delivered in the form of a PDF.

Badging System Structure

Ryerson aligned its badges to the programs listed below with their outcomes summarized. Please see Appendix A for details.

Clifton Strengths Training 1
Total number of learners: 23
Number of badges issued: 5
Assessment method: Survey to measure learning outcomes as presented in the session.

Clifton Strengths Training 2
Total number of learners: 10
Number of badges issued: 3
Assessment method: Survey to measure learning outcomes as presented in the session.

Clifton Strengths Assessment
Total number of learners: 1,011
Number of badges issued: 125
Assessment method: Completion of the Clifton Strengths assessment.

ThriveRU
Total number of learners: 11
Number of badges issued: 5
Assessment method: Completion of the four ThriveRU sessions and self-assessment based on learning outcomes.

LTO Level 1
Total number of learners: 144
Number of badges issued: 68
Assessment method: Completion of a course.

LTO Level 2
Total number of learners: 55
Number of badges issued: 19
Assessment method: Completion of a course.

User Experience

Total Number of Earners: 1,261

Use of Platform

We had 32 different issuing events for the eight badges that were created. We logged into the platform one to two times each week to check on the update of the badges.

Likes:

- Easy to design and upload badges.
- From an administrator standpoint, the system was easy to navigate.
- The reporting information was quick and easy to access.
- Assuming full integration with D2L, the system has the potential to be a valuable incentive for students to participate in programming.

Dislikes:

- The slow-moving technical support and length of time it seems to be taking to integrate into our LMS (eight months and counting) was an issue.
- The badges are not directly shown on LinkedIn; users must go to another link.
- Without very clear instruction, students had difficulty figuring out the process for accepting badges and adding them to LinkedIn.

Technical Issues

Technical difficulties with the integration of CanCred into our LMS (D2L Brightspace) caused signific ant delays. In the end, we had to abandon the integration with D2L Brightspace and change how we implement it, since the integration with D2L Brightspace is not available.

Experience w/Training

Training, support and response to questions were all handled in a timely manner.

Value

Please see Appendix A for information on the survey and results.

In terms of communication back to the community, we have started to speak with our partners participating in the Level Up program for the 2018–19 academic year. We will use the information collected through the survey to inform our badging process (distribution and marketing) moving forward this year.

Challenges

Our greatest challenge with the badging system was the lack of integration into our LMS. It was very difficult to operate two distinct systems (Level Up and CanCred) and achieve significant student buy-in. Due to this technical issue, the launch of the badging project was late, forcing us to reassess our initial plan.

Future Plans

We are currently working with CanCred to ensure integration into D2L before committing to a year-long contract. CanCred offered an extension for program use until October 31, 2018, as they continued to work on the integration with our Digital Media Projects team.

In terms of quality and sustainability of the badge system, the exponential growth of Level Up in the 2017–18 academic year was unexpected. Experiencing a jump in numbers from 153 to 8,577 unique users resulted in a need for us to revisit our strategy for high-touch student engagement. In doing so, we decreased the number of badges that would be offered, but offered them to more students. For the future, we have a strategy in place to partner with faculty to create tangible learning outcomes directly linked to competency development (similar to our process with the LTO) to award badges to students.

Lessons Learned

Lessons Learned

- Provide as much information about the process for accepting a badge as possible to students.
- Students must understand the value of the badge before they'll buy into it.
- Make competencies attached to receiving a badge clear and tangible.

University of Waterloo

Project Description

Our project goal was to develop strategies for enhancing student academic integrity knowledge using interactive scenarios through open access mobile technology, culminating with the achievement of a certificate and a digital badge to recognize completion. The vision of our digital badging research project aimed to explore the best strategies, from a student user perspective, for accessing and understanding student interest in using digital badges.

We carried forward our project goals and vision during the digital badging development process. Our initial badging pilot project was scaled down due to the seasonal timing of implementation of the testing process when students had completed schooling over the summer. We found the time it took for the quality assurance process for the IntegrityMatters app was extended due to multiple revisions before we implemented the badge testing into the final version of the app. We intended to ensure the bugs were removed from the app before adding the badge credentials through an APK file. We successfully tested the badging system for quality assurance and awarded a digital badge for completion of the mobile lessons on academic integrity at a passing rate of 75%.

Badging Team Description

The digital badge team comprised five members: the project technical lead, user experience/digital badge designer, principal researcher, and two staff from the Office of Academic Integrity.

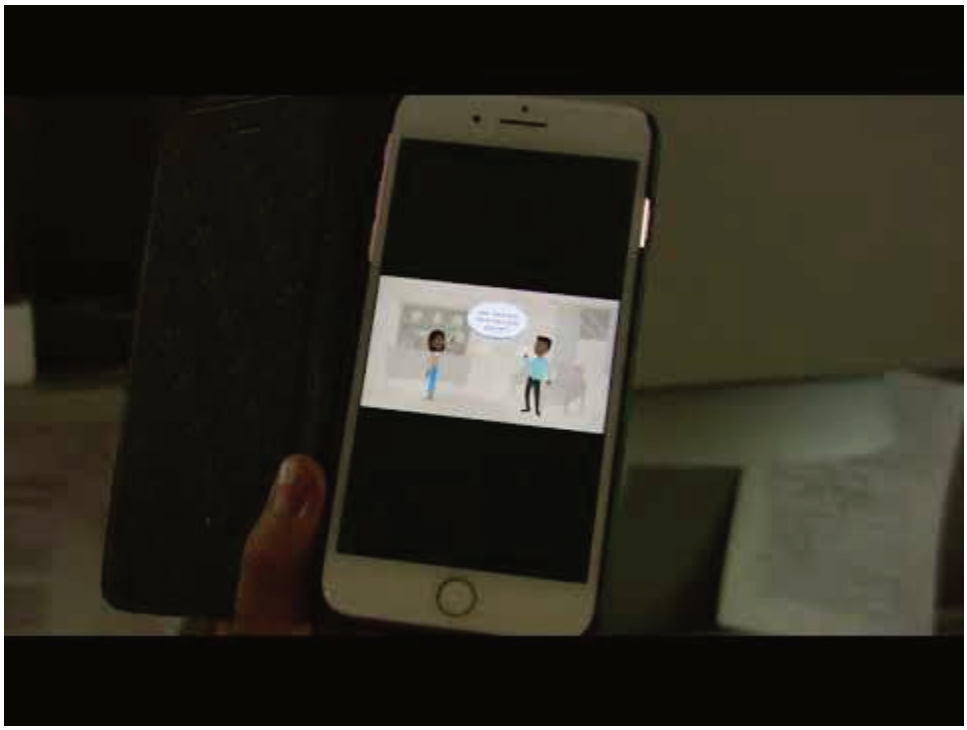
Two separate versions of our app, IntegrityMatters, were released to the iTunes Store and the Google Play Store in three separate language: English, French, and Mandarin.

Link to the App

- iOS: https://itunes.apple.com/us/app/integritymatters/id1355112345?mt=8
- Android: https://play.google.com/store/apps/details?id=uwai.dev.uwai&hl=en
- ID and Password: No (the IntegrityMatters app is open access)

Special Instructions: After selecting the language to interact with the application, you'll be presented with a login page. Scroll down to the bottom of the page and you'll see a button labelled "Login as Guest." Select that, and you'll then be able to interact with the application in full.

Our team developed an academic integrity digital badge, in addition to developing our own badge system design workflow (see Appendix B) and a digital badge training video.



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Study participants (undergraduate university students) who successfully completed the academic integrity IntegrityMatters app lessons with an overall score of 75% were invited to participate in the testing of our digital badge process. Study participants were asked to claim their badge at the CanCred.ca Passport site and export it to their social media profiles on LinkedIn, Twitter, Facebook or Google+ profile. In addition, they were required to complete a digital badging questionnaire (see Appendix B) to report on their experience. Some of the questions were scaling questions (1–5) where participants could add comments in text if they wanted to expand on their answers in the rating scale. The study results will be disseminated at conferences.

Badging System Structure

The Academic Integrity Digital Badge is awarded for successful completion of all the IntegrityMatters six modules with 75% or higher. Each module focuses on scenarios involving diverse aspects of

student academic life (cultural differences and expectations, physical stress, peer pressure, time constraints, etc.). Learners who successfully complete all of the modules are awarded a badge validating their competency in this functional area of academic integrity knowledge. Learners may choose whether or not to claim badges earned. Additionally, learners may choose to make their badges publicly viewable. When a badge is earned, an email is sent to learners who can then claim the badge at the CanCred.ca Factory Passport site (https://passport.cancred.ca).

Badge earners gained basic digital academic integrity knowledge; they are aware of the impact and outcomes of academic integrity in an academic setting. According to the International Center for Academic Integrity, academic integrity is "a commitment, even in the face of adversity, to six fundamental values: honesty, trust, fairness, respect, responsibility, and courage" (Fundamental Values Project, 2014). Learners experience academic integrity knowledge of the six values by completing interactive scenarios through open access mobile technology.

User Experience

Due to the unavailability of large student population in the midst of summer, we scaled down our project, selecting and awarding 77 mobile academic integrity digital badges. Forty users accepted the badge and completed the pilot testing. We tested the digital badging system and it was formally used for the research project.

Generally, the pilot users were satisfied with the platform and found it very easy to use and share on different social media. However, users reported some glitches where they were unable to directly input their badge to their LinkedIn account without copying the licence number and link from the badge site to LinkedIn. To address some of the technical challenges, the project team developed a training video to guide users to claim their badge for various social media. Users had access to technical support, as necessary, during the pilot testing phase. The project team felt it was necessary to support Unicode, especially for Asian languages, including Chinese and Japanese. This type of support could facilitate the issuing of badge to multiple language learners.

The project team is very pleased and grateful for the support from eCampusOntario, especially Don Presant for his willingness to share his expertise. We also appreciated the orientation sessions and virtual badging clinics, hosted by Joanne Kehoe, as a place to address questions and to talk with other colleges and universities who were testing digital badge implementation processes.

Value

We developed a 10-minute online questionnaire for users to complete to evaluate their badging

experience). Qualitative findings from this report included some helpful feedback from users. Responses from 33 participants who completed the badging questionnaire varied. Most were pleased to be able to add the badges to their social media platforms, especially on LinkedIn.

- Seventy-nine percent of users responded in Question 1 they were satisfied with their digital badging options. While some users found the badging process relatively simple to use, others were not sure their badge was placed in the social media platform of their choice. Some users indicated they experienced technical challenges with their mobile phones and were going to double check on their laptop computers to ensure the badge transfer was completed.
- In Question 2, a number of users indicated they were new to the badging experience, while others found the process a novel alternative to a certificate. One user comment indicated that, "it allows employers to see that we are certified individuals, and the URL provides a level of authentication to the badge." Twenty-seven percent of participants indicated they felt that badging was developing breakthrough technology while another 27% disagreed with this statement.
- In Question 3, almost seventy-one percent of student users indicated the badging process worked for them without any bugs, delays or errors. Some commented the training video was helpful for them to follow the steps to obtain their badge. One person indicated they had to re-enter their email address to claim their badge.
- In Question 4, over 87% agreed with the statement that digital badging was easy to use. Comments included, "Very simple and easy to follow. It's intuitive"; "The process is straightforward"; and "Adding it to LinkedIn was easy, especially with the YouTube video." Alternative feedback indicated that setting up an account "was a tedious process" for them.
- The responses to the question of whether digital badging is a useful process in Question 5 were mixed, with some participants agreeing (close to 30%), some disagreeing (27%), and some being neutral (33.3%). The comments shared that help explain the positive stance included, "It allows potential employers to see my badge without having to present a physical one to them," while others were unsure about the practicality of badges and whether others would recognize them, saying, "Not sure how credible an online badge is and whether it is easy to copy them."
- When asked about the value of staying connected to people important to them (Question 6), 42.5% of respondents indicated their university connection mattered to them; for example, "This badge is mainly for lab instructors/TAs/profs to show that a student understands the policies surrounding plagiarism," while almost 27.8% said that potential employers would be interested in seeing evidence of badging "can help employers identify more competent individuals." Sixteen percent indicated that badges wouldn't enhance connectivity to people: "Doesn't really aid in maintaining connections. Potentially aids in expressing your qualifications and achievements."
- Finally, study participants were asked how they would recommend enhancing digital badging in Question 7. Suggestions ranged from "Higher resolution, enhance image quality" to "Remove registration" to "Auto-filling the field so that you do not need to copy each field of information in order to share it on social media" to "Market badges better, make badging more prevalent."

Another suggestion included, "Make the badge public automatically, unless you specifically want to set it as private. Kind of like how Facebook posts work." A helpful suggestion was "Integrate it into LEARN [learning management system] so that students starting a new course/term will need to obtain the badge before submitting assignments. This would replace integrity quizzes the profs have for each course and can be done all at once with the badge as proof of agreement, completion, etc." Others indicated additional security for badging, such as, "I would add some level of further authentication in case the badge was provided to the wrong individual." Another commented on direct integration with social media: "Having direct links to share via Twitter, LinkedIn, Facebook, etc., if possible." Students often felt that badging was unfamiliar to schools and employers: "It needs to become a more widespread practice in order for it to be effective for students in the job search process." A few students indicated they would prefer to print the badge or have a tangible representation of completion of their work while others felt the badging process worked well.

Overall, participant feedback provided a range of responses, and the answers were very helpful to the research team. A student indicated that, "Badging was relatively simple to set up; it keeps up with the modern technology and is heavily used for connecting and self-marketing. A common response was that students wanted their badges integrated with the school's learning management system (LMS) to show their profs, TAs, and other students of the work they had completed. These responses encouraged us to seek funding to help support continuation of the digital badging in our IntegrityMatters project as we work to streamline our project into our learning management system.

In addition to this digital badging report, we made multiple conference presentations. We published a paper entitled, "Academic Integrity Matters: Successful Learning with Mobile Technology," co-authored by Alice Schmidt Hanbidge, Tony Tin, and Herbert Tsang, which was presented at the 21st International Conference on Interactive Collaborative Learning, Greece conference in September 2018. In our paper, we included this acknowledgement:

Acknowledgements: The authors wish to acknowledge research funding support from eCampusOntario. Also, the authors acknowledge support from the University of Waterloo, Renison University College, and Trinity Western University.

Challenges

We experienced and addressed a number of challenges during our digital badge development and testing process:

1. Interoperability with LinkedIn and other social media: the badging system needs to be more intuitive in terms of integration and interoperability.
2. System support for Asian and other languages is needed.

3. The subscription is not affordable for some smaller educational institutions. An affordable business model is necessary to sustain long-term engagement with digital badging.
4. More marketing and promotion would be helpful. People, our university student population, faculty, and staff were not knowledgeable about digital badging or had limited understanding of the benefits of badging credentialling.
5. Intrinsic and extrinsic motivators would be helpful to encourage undergraduate students to be lifelong learners with badging credentialling. If badge rewards were no longer desirable, student motivation could be reduced.
6. Digital badging processes need more interactive features, such as QR or AR code feature to enhance accessibility, visibility, and visual appeal.
7. More consideration should be given to promote proper academic behaviour that aligns with the learners, not the issuers.
8. The badge earner's performance is not directly observed so there could be some difficulty in making sure that the badge is awarded to the correct person who completed the assignment or met the specific badging criteria.
9. More research and evidence-based studies are needed to determine the effectiveness of using open digital badges in academic settings and what tangible positive learning outcomes it enhances.

Future Plans

This small-scale pilot was well received by the students and the faculty. In addition, the survey also indicated that, overall, students are satisfied with the badge system. We have already established well-defined badging criteria and a workflow system for granting digital badges upon successful completion of the lesson modules using mobile learning. We appreciated the opportunity to learn more about e-badges and to develop a prototype badge for testing with our academic integrity app. Thank you for welcoming us to your Basecamp and for hosting the badge clinics.

The American Councils for International Education (https://www.americancouncils.org) has expressed interest in our IntegrityMatters app. We are currently exploring how to best partner with them to endorse our app and our digital badge. A partnership will bring the IntegrityMatters app to its broad networks in higher, secondary, and primary institutions around the world.

We created a collaborative working group together with Kwantlan Polytechnic Institute in British Columbia to support them in translating our app into Punjabi and to create additional academic integrity scenarios to add to our digital databank of case scenarios.

Digital badging holds great potential for our institutional use. We secured funding through our eCampusOntario grant to renew our badge subscription for the upcoming academic year. It is

anticipated that we will make a good use of this digital tool to promote and educate our users about the value of academic integrity and benefit of open digital badges.

Lessons Learned

Lessons Learned

Strong support is necessary:

- Important to secure support and endorsement from your own institution.
- Ask for support from CanCred.ca, network with other institutions, attend workshops.
- Need to have technical support available to you to help design level of customization, branding, be familiar and how to integrate with LMS user experience, graphic designer, workflow, marketing strategy, operable-need plug-ins.

Develop clear project outcomes; design purpose for the badge—vision:

- Deliver clear criteria and achievement for the badge. How is it going to enhance the reward system? Need to know value of badge.
- Customized instructions are important.

Important to have marketing and promotional strategies for your digital badge:

- Users have questions; need to provide answers and how to claim a badge.
- Need a website to explain purpose, outcomes, and instructions.

Our research team wishes to sincerely thank eCampusOntario for continued support and encouragement in our project! Thank you for the opportunity to participate in the digital badging process.

References

Fishman, T. (Ed.). (2014). *The fundamental values of academic integrity* (2nd ed.). Des Plaines, IL: Clemson University. https://academicintegrity.org/wp-content/uploads/2017/12/Fundamental-Values-2014.pdf

Western University

Project Description

Western University's original vision for participation in the Open Badges project was to establish six "use-cases" across the institution to evaluate the conceptual feasibility of microcredentialling and the technical feasibility of the CanCred badging platform. We found four other interested collaborators across campus with badging use-cases that spanned curricular, co-curricular, pre-curricular, and professional development domains. At the end of the pilot, we had three collaborators (Ivey Business School, the School of Graduate and Postdoctoral Studies, Continuing Studies) and the Centre for Teaching and Learning who piloted nine different badges. During the active phase of the pilot, 202 individuals earned a badge created by a Western collaborator.

From the perspective of the unit coordinating the pilot, the project was a success. While not all institutional partners will continue to award badges or award badges via CanCred, through our assessment of feasibility we have been able to clearly identify aspirations and challenges for micro-credentialling at Western.

Each of the four teams describe their project in more detail below.

Ivey Business School

Our aim is to create badges that enhance pre-class preparation, in-class lessons, and more advanced topics not taught by professors at the school. We also want to make these badges available to alumni of our programs so they can continue to learn, mastering new skills that will ensure they are continually competitive in the job market of the future.

Our original goals and vision were to adopt Open Badges to enhance the more technical aspects of business study and improve our ability for students to differentiate themselves during the school-facilitated recruiting process. We want to increase avenues for students to effectively learn, which will create a better environment in the classroom and provide our recruiters with a more effective base of future employees.

The goals remained the same throughout the pilot, which the team considered to be one of the keys to success.

We consider this pilot a success due to the implementation of badges across the school as a way to

upskill alumni, teach current students, and introduce Ivey to prospective students. We are moving forward with a full commercialization effort at Ivey Academy, our new name of our Executive Education division.

School of Graduate and Postdoctoral Studies (SGPS)

The purpose of the Open Badges project conducted by the School of Graduate and Postdoctoral Studies (SGPS) was to pilot the use of open badging to recognize doctoral-student participation in a university-wide doctoral professional development program called Own Your Future. Own Your Future is a four-year curriculum-based program that facilitates self-directed professional development learning structured around six professional competencies. Through participation in Own Your Future, doctoral students learn to self-assess and communicate their skills to employers to gain a competitive advantage in today's labour market.

The goal of the open badging pilot was to evaluate whether recognizing participation in Own Your Future with Open Badges aligns with the program's long-term goal:

- To improve the ability of doctoral graduates to find and secure employment.

For the purpose of the pilot, we focused on alignment of Open Badges with the shorter-term goals of Own Your Future, which are:

- To improve the ability of doctoral students to self-assess and take initiative to expand their knowledge and skills.
- To improve the ability of doctoral students to articulate their skills to employers.

Specifically, we sought to address the following key evaluation questions:

- Are we able to define a set of criteria for each competency that reflects "proficiency" in a competency?
- Do Open Badges increase the ability of doctoral students to articulate their skills to employers?
- Do employers recognize/value Open Badges as a credible indication of professional skills?

Our goals and vision remained the same over the course of the pilot.

We consider the pilot a success. We were able to prototype an Open Badge for participation in an Own Your Future course, and we consulted with relevant stakeholders to conduct a preliminary analysis of the evaluation questions. We were able to gather sufficient insight from this pilot to address the evaluation questions, resulting in the recommendation that Open Badges not be used to recognize participation in Own Your Future.

Centre for Teaching and Learning

The Centre for Teaching and Learning (CTL) badging project focuses on faculty teaching development within a subset of existing workshops. The badges would be able to contribute to the development of learners' teaching e-portfolios/dossiers.

Our initial goals for the pilot were to explore possibilities for implementing badges into one of the professional development programs offered through the CTL, and for members of the CTL badge pilot team to work together to prototype and test the badging initiative with faculty and/or graduate student stakeholders.

Our goals remained the same for the duration of the pilot.

We were able to meet our goal of exploring possibilities for implementing badges for professional development. We explored badges in small programs. We were able to identify pertinent opportunities and barriers for implementing badges at the CTL and at Western as a whole.

Western Continuing Studies

Western Continuing Studies (WCS) delivers programs to the surrounding community to achieve its vision of innovative leadership in lifelong learning. The open badging project aligned with several key strategies to help us achieve our vision and goals. Micro-credentialling is an emerging trend in continuing education in Canada. The project provided us with the opportunity to explore the adoption of this important development in accessibility. It also allowed us to test the full function of the CanCred platform in a sandbox environment with minimal risk. The pilot project allowed us to:

- Experiment with adding a leading-edge technology into our pedagogy and infrastructure.
- Ensure program excellence by providing opportunities for our instructors to learn new skills and build a community of learning.
- Expand our learner-centred focus by providing our students with the chance to highlight relevant new skills.

Our original goals were to create and issue (1) professional development badges and (2) non-credit badges.

1. **Professional development badges (recognizing volunteer sessions like orientation, in-person development, and online modules).** The badge was designed to motivate and recognize the commitment from our instructors to improve their skills at voluntary professional development workshops. The earned badges would also be used during performance discussions with the

instructors. Topics include classroom leadership, rubric construction, lesson planning, etc.

2. **Non-credit badges (e.g., for completion or milestones of non-credit courses).** The goal was to implement and assess learner interest in obtaining badges upon completion of a non-credit course, and/or at milestones during the course. The hope was to test uptake of one open badge using a new non-credit course to assess WCS learners' readiness/interest in this technology and applicability to future non-credit programs and courses. Additionally, we had also hoped to be able to determine how much commitment would be needed by instructors/staff to create and approve the badges.

We shifted our goal from professional development badges for orientation, in-person development, and online modules to recognizing professional development that enhances instructor teaching and facilitation skills. As an alternative to creating one specific badge for various elements, we decided to provide multiple badges, including general attendance of sessions, knowledge application, and creating a community to share ideas.

At the completion of a non-credit workshop course, all successful students received a confirmation of completion. For the pilot project, we did not want to add any additional responsibilities to instructors, and for this reason we wanted to create a badge that recognizes a learner's ability to apply concepts outside the classroom.

The pilot was a success as it provided an excellent learning opportunity that otherwise might not have occurred at this time due to changes in staffing.

The experience also contributed to the department's learning and understanding about badges, especially my personal comprehension of badging. This provided a better understanding of what is important, including future platforms, the time commitments required to create a relevant badge, and the time required to assess an application and approve a badge.

As this was our first experience with digital badging, we were unsure of how many applications would be received. For this reason, very little advertising and communication was sent out prior to badges being available. Instead of mentioning that by taking a workshop students could earn a badge, a targeted email was sent to eligible participants after the workshop was completed to inform them of the opportunity to earn a digital badge.

Badging Team Description

Ivey Business School

Project lead: Tom Rochefort (manager, Learning Innovations Initiative, Ivey Business School)

Team members: Dr. Rob Austin (professor of information technology, Joe Paulin (analyst, Learning Innovations Initiative)

We collaborated with a variety of individuals across Ivey. The one group we lacked proper collaboration with was employers. We felt that introducing employers into the equation would have limited the impact we could have had during the course of the pilot.

School of Graduate and Postdoctoral Studies (SGPS)

Project lead: Julie Kaiser (professional development coordinator, SGPS)
Team members: Doctoral Professional Development Implementation Committee, faculty ambassadors, one to two doctoral students, and one to three members of SGPS administrative team

To develop competency-based badges, the professional development coordinator collaborated with other members of the SGPS team (associate vice-provost, postdoctoral services coordinator). The professional development coordinator also consulted with the course coordinator to identify badge criteria.

To determine whether Open Badges increase the ability of doctoral students to articulate their skills to employers, SGPS created an advisory committee that included two faculty members, one career counsellor, and one educational developer in graduate professional development.

SGPS plans to seek input from employers on the value of badges in the future.

Centre for Teaching and Learning Faculty Development

Project lead: Dr. Gavan Watson (associate director eLearning, Teaching Support Centre)
Team members: Dr. Beth Hundey, Dr. Lauren Anstey

We collaborated with Western University's communications team to set up a badging style guide.

We created a professional development badge that recognizes faculty and instructors' participation in a series of e-learning professional development events. One of our events focused on badges and micro-credentials, during which we sought input from our faculty member colleagues.

Western Continuing Studies

Instructor Professional Development

Project lead: Tanya Filipcic (program coordinator, Professional and Corporate Development, Western Continuing Studies)
Team members: Carolyn Young (director, Continuing Studies), Christine Wilton (program manager, Professional Development and Corporate), Nicole Tate-Hill (program manager, Post Degree), Patrick Vanhie (administrative officer)

Non-Credit

Project lead: Tanya Filipcic (program coordinator, Professional and Corporate Development, Western Continuing Studies)
Team members: Carolyn Young (director, Continuing Studies), Christine Wilton (program manager, Professional Development and Corporate), Nicole Tate-Hill (program manager, Post Degree), Patrick Vanhie (administrative officer)

Collaborations:

- Consulted with the director and program managers to see how they envisioned the badges being used. Helped to assess previous knowledge and ensure visions were aligned to scope of the pilot.
- For the design thinking badge, contacted an instructor that was using badges at another institution to learn from their badging methods.
- Tested the design thinking badge issuing process with two students in the workshop (also WCS colleagues).
- Attended meetings with other Western pilot participants.
- In December 2018, presented at a meeting at Western Continuing Studies to provide an explanation, share draft badges, and seek input on digital badges and update my colleagues on the progress to date.
- A sample badge was created for our customer service team to test out the badging instructions and ensure that the customer service team could provide basic troubleshooting.

Badging System Structure

Please see Appendix C for details.

User Experience

Ivey Business School

1. **How often did you use the CanCred platform?**

Five times.

2. **What aspects of the CanCred platform did you like or dislike?**

I did not like much at all. I disliked the entire user experience. It was awkward, clumsy and not user friendly at all. Furthermore, the idea that we had to pay to keep our badge pilots active is not a sustainable model. Additionally, any sort of regional application like this will not survive the shake-out phase of the industry life cycle. Credentialling is not a big money game and therefore small players like CanCred will not survive.

3. **Did you experience any technical issues with the CanCred platform during the sandbox period and if yes, how were they handled?**

No.

4. **What was your experience with training, orientation and support for the CanCred platform?**

Not great.

School of Graduate and Postdoctoral Studies

1. **How often did you use the CanCred platform?**

- January 2019: badge creation, six hours over one month.
- May 2019: badge issuing, two hours; badge approval, one hour.

2. **What aspects of the CanCred platform did you like or dislike?**

Likes:

- Appreciated that you could add a redirect URL after an applicant has completed the application.
- Ability to create email templates and contact lists.

Dislikes:

- Not able to personalize reply-to email through CanCred; I had to email students ahead of time to tell them to expect an email from CanCred when inviting them to apply to the badge.
- Not able to include first and last names of recipients in contacts list to personalize the email.
- Option to upload a file into the badge criteria.

3. **Did you experience any technical issues with the CanCred platform during the sandbox period and if yes, how were they handled?**

I was not aware that it was up to the recipient to select whether or not the evidence is displayed on their badge. When developing a badge application, I selected "yes" in the "use application form as evidence" section; however, this did not result in the evidence being displayed on the badge when I tested it.

I was able to resolve this issue with help from CanCred support. They explained that it is up to the badge earner to display the evidence, and they showed me how a badge earner can choose to display the evidence in the badge settings.

4. **What was your experience with training, orientation and support for the CanCred platform?**

See above.

Centre for Teaching and Learning

1. **How often did you use the CanCred platform?**

Roughly once every two weeks.

2. **What aspects of the CanCred platform did you like or dislike?**

Likes:

- Ability to use different badge criteria for earning.
- Relatively simple to initially create the badge.

Dislikes:

- Navigating the Creator tools with multiple levels of messaging—it was not always clear why information needed to be repeated.
- Not clear to earners how to share/keep their badges.
- Not clear how to allow users to share their artifacts.

- Badge earners have to go through too many steps to earn and claim their badge.
- During badge creation in badge factory, the information to be entered seems at times redundant.

3. **Did you experience any technical issues with the CanCred platform during the sandbox period and if yes, how were they handled?**

Badge users were unable to upload their work via the attachments tool (for our badge and for a badge within Western Continuing Studies). We notified contacts at CanCred and it was fixed in 26 days. In the meantime, we changed our badges to not require an attachment.

One of our badge .png files was off by one pixel in size and was unable to be uploaded. I was able to change the size but this strict requirement is something to keep in mind.

4. **What was your experience with training, orientation, and support for the CanCred platform?**

The initial response to a request for support was fast, but the issue took a month to reach resolution, as described by the Western Continuing Studies badge pilot team below.

Continuing Studies

1. **How often did you use the CanCred platform?**

- September to January: 12 to14 hours per month in the platform.
- January to August: 10 to 12 hours per month.

The average time to review, verify, and approve an application for a badge was approximately 20 minutes.

2. **What aspects of the CanCred platform did you like or dislike?**

Likes:

- I found it was a fairly easy system to use once I understood how to find the item I wanted to adjust (e.g., “active from date”; I needed to go into the badge application instead of the badge library).
- Ability to return a badge application with a personal message alerting the applicant why badge was returned. This seemed like a better approach than denying a badge.
- CanCred is affordable.

Dislikes:

- Would have been better if you could edit all the items from the badge library section rather than from the badge application section/milestone badges.
- Wish that you could see badge settings without having to edit them.
- Not able to add a hyperlink within the message being sent out to the student.
- Not being able to alter backpack details. Found it confusing that students received an email from badges@ecampusontario. This was resolved by providing information to the participants that this was a pilot project and where they would see the emails coming from.

3. **Did you experience any technical issues with the CanCred platform during the sandbox period and if yes, how were they handled?**

A badge application required applicant to upload an attachment. During testing when I attempted to upload an attachment, I received an error. I reached out to Gavan Watson to test and verify that he received the same error on May 2. Gavan confirmed he received an error and reached out to Don Presant. Don opened a ticket. On May 8, Don followed up with again due to a lack of response. On May 16, another follow-up was sent. On May 17, heard back that there was an issue with architecture of the Canadian CanCred cloud and would require moving the installation to a different Canadian cloud service provider which was expected to be done in June. On May 28, heard that the issue was resolved. Issue took a month in total to complete.

4. **What was your experience with training, orientation, and support for the CanCred platform?**

Gavan Watson and Lauren Anstey provided an excellent overview of the CanCred platform during an initial meeting with other pilot participants. When I ran into an issue, Gavan was willing to test, verify an issue, and escalate the issue to the next level.

When it came time for me to start exploring the platform on my own, I found it fairly intuitive and when in doubt I checked the FAQ section or other badge designs. I spent time creating a badge, making minor adjustments, and seeing how it changed the badge to get a better idea of what the platform could do.

Value

Ivey Business School

1. **Describe the methodologies and results from the data gathered from your badge earners and**

badge consumers (as relevant).

Completion rates:

- 18% of those who accepted an invitation to the micro-credential pilot participated in part or all of a micro-credential.
- 26% of those who start a micro-credential complete it.

Benefits:

At the beginning and end of each micro-credential, students were asked to assess their current level of proficiency in IT concepts or cybersecurity, as applicable, on a 5-point Likert scale with 1 being "Not at all proficient" and 5 being "Extremely proficient."

- For students who successfully completed the IT concepts micro-credential, average proficiency response increased from 2.52 to 3.37.
- For students who successfully completed the cybersecurity micro-credential, average proficiency response increased from 1.90 to 3.43.

Feedback:

In a closing survey, students were asked for feedback regarding their experience.

- 96% of respondents found micro-credentials to be an effective learning tool.
- 96% of respondents would use this tool as alumni to brush up on business topics.
- 54% of respondents would pay to have access to this tool if they weren't Ivey students.
- Students who would be willing to pay for badging products would be willing to pay, on average, $26 for a badge.

2. **Include any survey instruments or other supporting documents as attachments.**

Please see Appendix C.

3. **Describe how you will communicate these results back to wider community or stakeholders.**

We will be hosting town halls to socialize the impact of the pilot. We have also rolled out this as a product and, as such, will be spending on marketing to raise awareness of our new product.

School of Graduate and Postdoctoral Studies (SGPS)

1. **Describe the methodologies and results from the data gathered from your badge earners and**

badge consumers (as relevant).

Badge earners were redirected to a survey upon completion of the Leader Character Badge application that asked the following series of Likert-scale questions with answers ranging from 1 (strongly agree) to 5 (strongly disagree):

- I feel that a digital badge adequately recognizes the professional development program I completed. Mean response: 1.6, n = 12
- I was happy to receive a digital badge for completing a professional development program. Mean response = 1.4, n = 12
- I would rather earn a digital badge than a certificate of completion (on paper) for professional development activities. Mean response = 1.8, n = 12
- The digital badge seems credible to me. Mean response = 1.75, n = 12
- I am interested to participate in more professional development to earn more digital badges. Mean response = 1.2, n = 12
- I plan to include digital badges in conjunction with a portfolio of work to document my professional development work. Mean response = 1.6, n = 12
- I plan to include digital badges on my LinkedIn or other social media profile. Mean response = 1.3, n = 12
- I plan to print the PDF file as a certificate to add to a physical portfolio. Mean response = 1.8, n = 12

The Leader Character digital badge is being piloted as one badge in a series of three that PhD students can earn to receive a milestone badge that recognizes completion of the Leadership competency in the Own Your Future program.

Please share any additional thoughts, questions, concerns you have regarding digital badges.

- "I think it's a great recognition."
- "This is a great idea and opportunity for Western graduate students! Thank you!"
- "I have not seen digital badges in the past, so I am not sure how credible they will appear to prospective employers."

2. **Include any survey instruments or other supporting documents as attachments.**

Link to feedback survey: https://uwo.eu.qualtrics.com/jfe/form/SV_3meVDtOm0mW8mUt

3. **Describe how you will communicate these results back to wider community or stakeholders.**

We planned a panel presentation at the Fall Perspectives on Teaching Conference, Western University, August 2018: Lessons from Early Adopters: Digital Badging at Western.

Centre for Teaching and Learning

1. **Describe the methodologies and results from the data gathered from your badge earners and badge consumers (as relevant).**

N/A

2. **Include any survey instruments or other supporting documents as attachments.**

N/A

3. **Describe how you will communicate these results back to wider community or stakeholders.**

Our primary source of information is user experience from the badge issuers. We will be hosting a panel session (Lessons from Early Adopters: Digital Badging at Western) at our annual fall teaching and learning conference and also writing a report for the Western community.

Western Continuing Studies

1. **Describe the methodologies and results from the data gathered from your badge earners and badge consumers (as relevant).**

Although the application rate was lower than expected, the claim rate was quite high. For the design thinking, 73% of the badges were claimed (8 out of the 11 approved applications). For the WCS learning community badges, the claim rate for the Participate badge was 79%, and for the Apply and Share badge it was 100%.

Applications for the Design Thinking badge were low. When we followed up with those students who were interested in applying but didn't follow through, the standard response was "I forgot" or "I just didn't have time." Of those applications received, the artifacts supplied were really well written and indicated that thought did go into application. In fact a few students supplied additional documentation in the form of a journey map to support their written document.

For applications that were left in progress, we reached out to see if there was anything we could do to help them complete their application. If the application was sent back for revision, we provided a detailed explanation of why the application had not yet been approved.

Application status from CanCred report:

- Design Thinking: Approved (11), In Progress (2), Returned (4)

- WCS Learning Community, Participate: Approved (11), In Progress (1)
- WCS Learning Community: Apply (2)
- WCS Learning Community: Share: Approved (1), Returned (1)

2. **Include any survey instruments or other supporting documents as attachments.**

N/A

3. **Describe how you will communicate these results back to wider community or stakeholders.**

- Late June: prototype team members had a meeting to share the badging results. A discussion was held on future plans for badging at WCS.
- Next steps for communication: final results from the pilot project and next steps will be discussed with the WCS team.

Challenges

The challenges summarized below were identified by the four partners involved in the pilot.

Sustainability of Badge Metadata

At the vendor level, the major threat is related to the sustainability of the metadata behind earned badges. CanCred only guarantees that badge metadata will be accessible for 24 months after a subscription ends, so we are now working with the assumption that any badges earned during the pilot will no longer be viable after two years.

It is the contention of the institution that any badges awarded for academic achievement must not disappear, which has implications for curricular badging projects with CanCred. Prototype teams with pre-curricular projects also noted that it was part of their project design for in-program students to have access to badges to demonstrate the achievement of program outcomes up to 36 months after achieving a badge.

A badge record store, independent of the vendor's system to create and award badges, is an integral component of a fully viable badging system. Subscribing to a badge record store to ensure that micro-credentials are sustainable increases the cost of a badging system.

Institutional Micro-credential Policy Gap

At the institutional level, we need to address the need for oversight in the creation of curricular badges and approval of badge criteria. The role of micro-credentials as ways to evidence competencies needs to be clearly defined in the institution's landscape, where there are already departmental and faculty-level processes in place, aligned to Senate policy and procedures, to provide oversight on the approval of new or major changes to courses and programs. If a micro-credentialling policy is put in place for oversight of criteria and design, this will carry staffing costs.

Branding

The regional specific brand CanCred prevents commercialization of badges into global markets. Furthermore, the lack of white-labelling prevents school specific branding on the backpack pages.

Integration with LMS System

At Western we have a working integration with Sakai, the learning management system (LMS). The implementation of this integration with the LMS may be important to the overall success of the badging pilot.

Integration with Registration System

Western Continuing Studies recommends an integration with their registration system, DestinyOne. DestinyOne is currently being used by five other schools in Ontario, and another badging platform, Credly, currently has an integration with DestinyOne. Continuing Studies feels that having a badging platform that has an integration point with DestinyOne will provide a seamless process for students to apply for badges. Additionally, it will allow the display of badges (and metadata) in our instructor profiles found on our website.

Badging versus Co-Curricular Record

Badges or micro-credentials offered through Western will need be clearly defined to distinguish from the co-curricular record (WCCR). Currently, items on the co-curricular record are coordinated

through the university and validated by staff members. Because the co-curricular record could be perceived to have a similar role to a badging platform on campus, communication concerning badges will need to emphasize the utility and difference of Open Badges. For example, whereas WCCR chronicles participation in co-curricular activities outside of the classroom, badges can represent curricular competencies and non-credit learning experiences. Badges can also be used to recognize achievements and competencies for graduate student and non-student members of the university community, whereas the WCCR is geared for undergraduate students.

Employer Recognition

Badges can be used to demonstrate competencies to our students' future employers, but to do so employers need to recognize badges in general and, in particular, Western's brand of badges. Therefore, a challenge is in employer recognition of badges and also ensuring that Western's badges are only awarded for demonstrating the outcomes of meaningful learning experiences.

Future Plans

Ivey Business School

1. **Indicate if and how your badging initiative will continue.**

Via a commercialized product through our Executive Education department.

2. **Describe what you might need and how you will ensure the quality and sustainability of your badge system.**

We will need approximately $200k of annual overhead which includes a product manager, product coordinator, and associated fixed costs.

3. **Include details around any third-party endorsement, monitoring, and success indicators as well as plans for scaling up and/or engaging new partners.**

We will be working to build a comprehensive strategy once we staff this new division with the right folks. Please feel free to contact me at a later date for additional information.

School of Graduate and Postdoctoral Studies (SGPS)

1. **Indicate if and how your badging initiative will continue.**

SGPS does not plan to continue using Open Badges to recognize participation in Own Your Future.

To address our question, "Are we able to define a set of criteria for each competency that reflects 'proficiency' in a competency?", the professional development coordinator (PDC) consulted with the course coordinator to identify the course activities that could serve as criteria for competency recognition, and three criteria were determined: passing grade (i.e., participation) in the course, development and facilitation of a workshop, and a reflective essay. When this same approach was applied to mapping out an open badging constellation for the full program, the PDC encountered the following challenge:

> Own Your Future recognizes that doctoral students come into their studies from a variety of backgrounds and each has unique personal and professional goals. Therefore, there are no required workshops/courses that students must take. Rather, Own Your Future is intended to empower students to assess their own needs and skills and engage in strategic professional development (inside and outside the program) to meet their personal and professional goals.

The team therefore decided that Open Badges are not ideal for recognizing participation in Own Your Future at this time because the primary intention of Own Your Future is for students to be the primary evaluators of their skill proficiency and not a formalized credential.

To address our question "Does an Open Badge increase the ability of doctoral students to articulate their skills to employers?" an advisory committee (two faculty members, one career counsellor, one educational developer) met to discuss how different "credentiallizing" options, including Open Badges, might align with Own Your Future's goal of improving the ability of students to articulate their professional skills to employers. The committee agreed that, ultimately, for students to articulate their skills, they first need to be aware of the skills they develop in their PhD and reflect on their personal and professional growth throughout their PhD. Only then can they create a narrative that articulates the unique abilities they bring to the workplace. A survey of students who received an Open Badge through the pilot project indicated that students planned to include their badge on their social media profile and/or a physical career portfolio. However, more data is needed to determine if Open Badges helps students reflect on and/or communicate their skills. Given that SGPS has data supporting that another program component, the Own Your Future Self-Assessment, does increase doctoral students' awareness of the skills they develop and helps them articulate their skills, the team concluded that, without more evidence, Open Badges do not bring additional value to meeting the Own Your Future goal of improving the ability of doctoral students to articulate their skills to employers.

To address our question "Do employers recognize Open Badges as a valuable indication of

professional skills?" the team consulted with the Career Services unit at Western to gain their insight into how employers perceive credentials, such as co-curricular records. SGPS was not able to consult with employers in the time frame of the Open Badges pilot.

The Career Services team advised that employers value the ability of candidates to articulate their professional skills over the presence of a "credential" representing the professional skill in a career portfolio or on an online profile. SGPS is in the process of creating an Employer Advisory Committee to explore this topic further. However, for the time being, the team concluded that without more evidence to suggest that Open Badges increase the competitiveness of a candidate, Open Badges do not align with the Own Your Future goal of improving the ability of doctoral graduates to find and secure employment.

2. **Describe what you might need and how you will ensure the quality and sustainability of your badge system.**

N/A

3. **Include details around any third-party endorsement, monitoring, and success indicators as well as plans for scaling up and/or engaging new partners.**

N/A

Centre for Teaching and Learning

1. **Indicate if and how your badging initiative will continue.**

We are extending the pilot by one year (to August 2019). We will offer the eLearning Lunch and Learn, the Lesson Design, and the Lesson Facilitator badges again. We will consider incorporating badges into our existing graduate and faculty development certificates, which are made up of a flexible suite of other professional and teaching development activities.

2. **Describe what you might need and how you will ensure the quality and sustainability of your badge system.**

We will need to explore the badge record store and other options to ensure sustainability of the badges. We will also need to further investigate institutional barriers on badges.

3. **Include details around any third-party endorsement, monitoring and success indicators as well as plans for scaling up and/or engaging new partners.**

N/A

Continuing Studies

1. **Indicate if and how your badging initiative will continue.**

Alternative badging platforms are under review and consultation with other schools using badging is underway. As DestinyOne has an established partnership with Credly, this platform is being considered.

The Instructor Professional Development badges will continue in either CanCred or another system. Future badges will be promoted during upcoming events to encourage applications. New badges will be designed to focus on on-boarding and orientation of instructors. Program managers will become application reviewers to help promote professional development badges and use the application documentations during an evaluation process.

Exploration of other badges are being considered for other areas of Continuing Studies programming:

- More non-credit courses, such as the accelerated project management program. A series of badges are being considered as a way to motivate and acknowledge a student's successful completion of the knowledge areas as identified within the PMBoK (Project Management Book of Knowledge).
- Badges within credit programs. Creation of a Components of Professional Conduct badge is being considered, whereby the credit students can choose to participate in spark session/ workshop programming that will complement skills being obtained in the program. For example, credit students could complete a spark session on "strategies for resilience and success" and "sparking creativity and engagement" that will help them become more successful in their future practicum or career.
- Corporate training. Instead of issuing a certificate of completion, a specialized badge could be created to acknowledge the completion of the course/workshop.

2. **Describe what you might need and how you will ensure the quality and sustainability of your badge system.**

Staff resources would be the key to helping ensure the quality of the badge system. Instructors would need to be educated on how to create and incorporate meaningful badging into their curriculum. We would also need to ensure that the instructor is supported through the approval process.

We need a dedicated badging platform so that all our badges are housed in the same place. A shared platform with other departments would reduce financial costs and increase the local resources

available to troubleshoot questions, research solutions, and generate ideas on badge creation without placing too much strain on one department.

3. **Include details around any third-party endorsement, monitoring and success indicators as well as plans for scaling up and/or engaging new partners.**

- Provincial guidelines for Ontario universities issuing badges ensures validity and integrity of badges issued.
- Badges for the accelerated project management program require endorsement from the Project Management Institute (PMI). PMI currently has digital badges through Acclaim, so would need to verify that there are no overlaps between our badges and other badges.
- Education of the general population is crucial. When the director or program managers mention digital badging or micro-credentials to corporate partners, they often need to explain what they are. Having a brief information package on badging might help employers learn more about them and realize the significance of them.
- Report on how the badges are being shared by WCS students.

Lessons Learned

Lessons Learned

- Badges have a bottom-up appeal (different partners at the institution have ideas for implementing badges in their own program or context), but they also require clear institutional policy and governance structure in order to ensure quality. Interest out-paced policy, which threatens our badging initiative's viability.
- A badging platform needs to guarantee metadata sustainability and data ownership. It is disappointing that CanCred requires an additional subscription fee for the institution to host its own Badge Record Store (BRS) but, without that BRS, does not guarantee retaining the metadata after a subscription ends. Without ensuring the perpetuity of badge metadata, badges will not be adopted for curricular purposes.
- Collaboration and partnership from across our campus was key to the success of the pilot. We learned different lessons about what works (and doesn't work), and can make a better case for launching badges after knowing how it works with multiple partners.

York University

Project Description

The York University Online Digital Badging System has been an integral aspect of the forward momentum of the BEST Lab. The Digital Badging system motivates the engagement of students by gamifying the education process, but also by creating a digital road map for the educational expectations with smaller qualifying badges acting as guide posts that allow students to self-evaluate and adjust their teaming strategies. The digital badging activity embraces curricular and co-curricular activity.

The flexible nature of the badging concept allows the accredited integrity of the overarching degree system to be respected, while allowing small modifications to education requirements. It allows for the awarding of micro-credentials both with a course and through alternate experiential education activities.

Interestingly, it has allowed us to develop and create a dialogue with industry and workplace partners who can be given a voice in badge development, aligning specific learning outcomes with workplace requirements. This allows industry partners to highlight skills and abilities they desire, and universities to build new graduate capabilities to address current shortcomings. One of the benefits of this is it allows for rapid prototyping of specific badges (see below) without the need to overhaul the entire degree system. This speeds up the implementation of academic change, allowing the educational process to be changed pre-emptively and proactively.

For example, York has developed a strategic partnership with IBM (an industry partner with noted internal success employing digital badging) to deploy digital badges. Lassonde School of Engineering currently has 36 co-op students at IBM in Markham. This partnership has been enhanced by MTCU/ MAESD funding of the Catalyst Skills Initiative (which includes IBM and many other academic and industry partners). The first two digital badges being developed in this partnership are for resilience and refection–determined to be critical skills in enhancing innovation and creativity (linked to another BEST eCampusOntario project).

We are optimistic that with the development of a formal badging process, the integration of badging into co-curricular student records, and rapid acceptance of industry partners, the Digital Badging initiative at York University will have the strength to change the future of education.

Badging System Structure

We present two contrasting new digital badges—one experiential (participation) and one skill-based—as examples of the new ways in which micro-credentials are transforming our approach to education and creating both experiential education and appropriate skills development.

Experiential Badge—Resilience

The resilience badge developed in partnership with IBM is designed to recognize the education value derived from failure and the ability to continue and persevere by learning lessons from failure. Much of the innovation work we do demonstrates the inherent value in learning what does not work and being able to reflect on it in a way that improves the likelihood of future success. (It is interesting to note that, in the Canadian context, while these skills are often desired, they are not encouraged or developed. Rather, we seem to create a culture of fear of failure, which in turn reduces our capacity for innovation.)

Skills Badge—3D Printing

We've developed hands-on badges for 3D printing to highlight the skills involved in identifying components that can be constructed to be 3D printed together. This badge is offered in multi-level stages of competence (bronze, silver, and gold).

The badge requires students to display the technical design of computer modelling components from many sources: SolidWorks, SketchUp, AutoCad, and TinkerCad. It requires the technical design of understanding how each component in the project integrates into a larger system while also including a reference to design-for-manufacturing thinking to motive students to consider how their project can fit into a larger industrial method.

The silver badge tests more sophisticated 3D printing skills, such as optimization and materials selection, while the gold level badge recognizes mastery—that is, the ability to teach others.

Value

The challenge within an academic environment is to encourage and motivate the students to push themselves to achieve more and to discover their inner strengths. Using badges such as reflection and resilience helps us focus on key attributes that are currently not shared with students (despite their importance).

Digital badging also gamifies the achievement of badges by allowing students to chart their accomplishments and express their interests and achievements in multiple activities. This promotes

and rewards individual student initiative and connects each student to the larger student body, contributing to community building.

The early involvement and creation of guidelines, or a system of vetting badges through approved university channels, allows badges to be branded appropriately and have value in a real-world industry setting.

Working with industry partners to create these guidelines is also essential. Otherwise there will exist a disconnect between the criteria of recognized co-curricular skills at the university level and at the employer industrial level.

The creation of unique one-time badges can be connected with other awards such as a scholarships to motivate students and create unique value for their activities.

Challenges

There are three major barriers to success at York:

- The first barrier is the duality of curricular badges and co-curricular badges. Co-curricular badges are the heart of what makes digital badging innovative by recognizing the nuanced educational requirements of the degree program and student initiatives, but the program requires curricular badges to provide stability and draw attention to the system. The challenge is finding the correct balance between the two (while maintaining the integrity of the badging system).
- The second issue is creating co-curricular badges in an academically accredited environment. Some believe that badges need to be formally approved because they are issued by the university, but this inhibits the adoption of new and innovative badges. There will be some effort required to find a middle ground between university administration and those trying to deploy the digital badging program.
- The third issue is a lack of dedicated resources. Moving from a few simple badges to a campus-wide initiative requires much more planning and resources than we have been able to dedicate. This issue is exacerbated by the ambiguous nature of the project, benefits, and limited resources that exist to support students across faculties. There is also a constraint imposed by inexperienced staff and unclear objectives.

In the midst of several competing priorities related to advancing teaching and learning strategies, advancing the goals related to development and implementation of a fulsome and robust badging system may be challenged by limited resources. The university remains interested in the opportunities for students related to digital badging and committed to the success of these initiatives,

and our team continues to strategize on how to obtain resources to support the related projects and expand the project to include additional faculties and academic programs.

The creation of an Ontario-specific unique badge system provides a technological threat due to the in-house work requirement. There already exists a monopoly company providing superior service for setup and badge management in a purely non-academic sense. Creating an in-house system takes away from the academic potential by overwhelming the user base with additional concerns about the technology that draws resources away from the academic and innovative objectives.

Future Plans

We are delighted to be continuing with the digital badging program at York, although we still have to find a suitable model to support the issuing and awarding of badges, as well as to cover the costs of skills development or experiential learning opportunities.

We see some very simple badges being created at Lassonde in the short term (focusing on hands-on skills lathe projects, mill competency, and computer numeric control training), as well as the more difficult task of teaching soft skills desired by industry partners (design thinking and creative problem solving).

We are building interest on campus in digital badging (for example by engaging with university clubs or linking to specific experiential education opportunities such as international experience programs). Over time we are sure that digital badging at York will contribute as much to student success as the more traditional acquisition and application of knowledge).

We have discussed our go-forward plans with workplace partners and decided to use the Credly platform (which we were on previously) for a number of strategic reasons.

Lessons Learned

Lessons Learned

- We have learned much about the two challenges of badging: developing a system to award badges and creating a platform (that integrates with others) to track badges earned.

Open Badging: Additional Resources

Curated Resources

Badging is an evolving resource in Ontario's teaching and learning environments. These links provide both background information and report on badging initiatives in higher education.

- 21st Century Skills Badges
- Aggregation of Badging Research and Resources- http://bit.ly/OB4eCO
- Badge News
- Bestr Initiative
- Digital Credentials Institute
- How to Integrate Open Badges with LinkedIn
- Humber College Micro-Credentials Initiative
- Ontario 2017 Open Badges Forum Report
- Slideshare presentation (presented to Ryerson)

VIRTUAL SIMULATIONS: LABSTER

Key Findings: Virtual Lab Simulations

Virtual Lab Simulations Overview

Virtual labs and gamified simulations expose learners to exercises and practice opportunities that, in "wet labs," would normally involve costly equipment, hazardous materials, and techniques that are difficult to provide equitably across students, programs, and geographical locations. Exposure to these methods of investigation is critical to meeting curriculum learning outcomes. Within the STEM (science, technology, engineering, math) disciplines in particular, "simulations and games have great potential to improve science learning in… undergraduate science classrooms" (Honey and Hilton, 2011).

Implementing virtual labs in post-secondary teaching is gaining traction because of the increased demand on physical lab spaces and the barriers of cost, safety, and time required to ensure student preparation. Virtual labs can avoid these barriers and better prepare students for wet labs. A virtual lab can function as a supplement to a wet lab or a pre-lab requirement, or can replace the wet lab experience (Bak et al, 2013).

In studies measuring the benefits of virtual labs, students report that they are an engaging alternative to a lecture-based introduction to wet labs, saying that the self-paced completion and ability to pause and review material contribute to better individual and collective learning outcome achievements (Bak, Dandanell, and Sichhlau-Brunn, 2013). There is also evidence of higher learning outcome achievement when the virtual labs are used in tandem with traditional teaching methods (Bonde et al., 2014).

In addition, gamification elements contained in virtual simulations have been shown to increase motivation and interest in pursuing education in STEM fields (Bonde et al., 2014). Another interesting finding is that students feel less anxiety when introduced to lab practices virtually than in the wet labs, and this alleviated their concerns when preparing to enter the wet labs for the first time (Bak et al., 2013).

The eCampusOntario Educational Technology Sandbox case studies involved integrating virtual labs into a variety of STEM courses (e.g., engineering technology, general chemistry, human biology). Most implementations accompanied face-to-face classes, but a couple were part of an online cohort. The project at the University of Toronto was coupled with a previously funded research and innovation grant, and thereby offered a longer and more intensive evaluation opportunity. All institutions that participated indicated interest in virtual lab simulations as a possible solution to limited availability of physical lab resources as well as a means to deliver the content to more students more often.

Virtual Lab Simulation Teams

The virtual lab simulation teams comprised faculty, staff from teaching and learning centres, continuing education staff, program coordinators, advisory committee members and in some cases, senior administration/leadership team members. Identifying a project lead was part of the expression of interest process, and identifying and describing the responsibilities of this role was critical at the outset.

Those teams that planned and held regular communication and project check-in meetings, either face-to-face or virtually, appeared to be more successful. Centennial College was of particular note: their meetings included not only institutional team members but also members of Labster's support team. Frequent meetings helped them navigate implementation challenges, such as mapping simulations to curriculum and responding quickly to support issues.

Integration

The labs were integrated in a variety of ways:

- As a supplementary study aid.
- As a low-stakes assessment.
- As a required assessment.
- Before class (flipped).
- In-class (active learning) or as an assignment.
- As a bonus activity/study resource.
- As a reinforcement of challenging topics raised in class.
- In tandem with instructor-created lab reports.
- As a pre-tutorial assignment.
- In face-to-face, blended, and online classes.

Assessments ranged from 5% to 15% of the course grade and largely were dependent on the number of labs students were expected to complete during a course.

The University of Ottawa integrated the tool into the same course twice under different delivery formats: face-to-face in the fall term and online in the winter term. They also translated the labs into French through a separately funded project.

For lab-based courses, completing a relevant lab was a prerequisite to entering the physical lab. For theory-based courses, the simulations were used to help solidify concepts introduced in class. For the most part, learners completed the labs individually, on their own time. However, in some cases, they worked through the labs in small groups.

The University of Toronto project allowed students the freedom to choose five out of 23 selected labs. Students also completed an exit survey as a lab skills workshop credit/certificate. This approach was intentionally not tied to curriculum in order to offer students an opportunity to deepen their learning on labs that were otherwise unavailable.

The labs that were integrated as a bonus mark or as an optional study aid showed a very low uptake by students, with an average of 20% participating. There was much greater engagement and feedback when the labs were a mandatory part of the course.

Benefits

The value of the labs was more apparent with online learners, providing them with a lab experience that was as close to the real world as possible. But both students and faculty reported several other benefits to participating in virtual labs.

Students:

- Felt more engaged in the material because of the interactivity.
- Liked the flexibility to learn according to their own schedule.
- Improved their critical-thinking capabilities and mastery of skills because they could test and retest their understanding of concepts, troubleshoot various experimentation processes, and interpret the results.
- Reported that the labs were effective in teaching the concepts behind the experiments.
- Appreciated being able to follow up on the resources that accompanied the labs.
- Liked getting immediate feedback through the assessment upon completion of an assignment.

Faculty:

- Appreciated having the dashboard to quickly assess individual student performance within each of the labs used.
- Liked having the ability to replicate situations and present material that may not be possible, or that would be more challenging, in real-world scenarios. For example, Centennial College reported the advantage of giving students the opportunity "to observe otherwise unobservable biochemical phenomena," introducing them to concepts and processes in a unique and visual manner.

Challenges

The following specific challenges were reported:

- Some content was too advanced for certain curriculum and was difficult to integrate into courses; educators would have preferred to remove certain elements.
- For some, it seemed that the labs were designed for more advanced, upper-level university courses rather than introductory levels.
- Alignment with learning outcomes was difficult, especially with well-designed, established courses; in these cases students were exposed to content that seemed to have no relevance to course outcomes.
- The labs were lengthy, and some students found progressing through them tedious.

Generally, there were strong indications that however beneficial virtual lab simulations are, they cannot be used in isolation. Time spent in a physical lab with hands-on, practical activities is required—in particular when thinking about meeting curriculum learning outcomes and student learning needs. One faculty member noted that it wasn't possible to actually collect and interpret data—a critical outcome for her course—in the virtual labs. Many students also reported preferring the tactile physical lab experience, saying that they were receiving an inferior learning experience with the virtual labs.

In response to these challenges, it is important to note that simulations can be used effectively in tandem with real-world applications.

User Experience

The labs were reported as being easy to use, with setup and student registrations being seamless with the support of the Labster team. The resources and reference materials provided supported mapping the labs to curriculum learning outcomes.

Anecdotal evidence from students was positive, indicating that the experience left them feeling better prepared for real labs. Some reported that the animations were realistic and that the lab was a well-designed user experience. Users liked being able to control the pace and progression, and the ability to repeat assessments to achieve better scores and understanding of the concepts being tested. Having immediate feedback on the quizzes was effective.

Not all comments were positive. Some said the interface was sensitive to cursor placement and did not display properly on all monitor widths (e.g., screen buttons and tabs were incorrectly positioned). In addition, at times, the simulations seemed to lag or freeze midway depending on the computer operating system and connection speed. Freezing labs was particularly problematic if it meant

students had to start the lab over. Students also noted some inconvenience in the simulations working better on desktop computers versus mobile devices. Users also noted a need to create a single sign-on interface with all institutional learning management systems and tie performance to grade books. At the time of this evaluation, only Blackboard's grades linked to Labster.

There were a few other negative remarks about the user experience: not having a full transcription of the instructions was inconvenient and didn't promote accessibility; the computer-generated voice and strange pronunciation of words and terms was off-putting, and the length of the labs was challenging (for both learners and educators).

University of Windsor reported another specific challenge: The institution is developing new policies on the use of educational technologies such as Labster, which includes more rigorous scrutiny on tools, particularly for privacy and risk abatement. It is important to recognize that institutions should be encouraged to engage in an evaluation of educational technology, and this process and its accompanying timelines should be considered as an important part of any future proposals.

Future Plans

Cambrian College, Canadore College, Lambton College, and the University of Guelph indicated that they were not planning to use Labster's virtual lab simulations in the near future, mainly because they were not able to customize the labs to program and course learning outcomes. The uncertainty of cost and how that would be sustained was also a concern.

Institutions that reported they would likely continue were Centennial College, Durham College, Mohawk College, Sault College, University of Ottawa, University of Toronto, and the University of Windsor.

The institutions that reported they were more likely to continue integrating the labs into their technology road map were able to integrate the project with institutional priorities. Those who were keen said they were looking forward to the release of additional labs in anatomy and physiology. One institution surveyed their students, who indicated a willingness to pay for the labs if the cost was manageable and replaced textbook costs.

Lessons Learned

Lessons Learned

A number of the lessons learned reported by institutions were common across projects and seen as critical.

- In the evaluation of any learning technology, it is important to engage with students on the rationale and get their buy-in as assessors. Their active evaluation and reflection on the usefulness of the labs as a learning tool is critical.
- Giving students a specific time frame to complete the labs is beneficial, rather than presenting them as an open supplement.
- Adequate planning time is needed. Some institutions noted that it would be ideal to build a course around the labs rather than trying to squeeze labs into existing curriculum.
- With this project the licences were available at the start of the fall term. For an effective evaluation, a six-month planning period would be optimal prior to integration.

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Cambrian College

Project Description

This proposal involves incorporating six Labster simulation labs into two courses of the pre-health sciences program as a means of evaluating the impact on student success and the potential for implementation into future course deliveries. Pre-health students are those completing prerequisite courses to meet admission requirements for any of Cambrian's Health Science advanced diploma or degree programs. The two courses selected to incorporate Labster simulations are BIO1003–Biology I and BIO1010–Biology II. In the pre-health science program, there are currently no physical biology labs that are conducted. Students consume course content only and demonstrate their grasp of procedure and knowledge through written assignments or tests. The integration of the simulation labs into coursework as formative or summative assessments would address the gap of students participating in experiential learning. Below is a list of the proposed labs that would be evaluated along with the learning competencies required of the course.

BIO1003–Biology I
Lab: Cellular Respiration
Competency: Identify cellular molecules, discuss cell transport processes, and describe cellular metabolism

Lab: CSI
Competency: Describe the structure and replication process of DNA

Lab: Introduction to Food Macro-molecule Competency: Identify biological molecules and describe their properties

Lab: Protein Synthesis
Competency: Define protein synthesis and the roles of mRNA, rRNA and tRNA in protein synthesis

BIO1010–Biology II
Lab: Antibodies
Competency: Describe how the body defends itself from pathogens (immune system/body defences)

Lab: Carbohydrates
Competency: Identify the location of the breakdown of proteins, carbohydrates, lipids, and some other substances

This project would focus on using these labs to supplement the learning competencies in BIO1010 and BIO1003 face-to-face and blended courses. This would provide students with an opportunity

to succeed in real-world situations by acclimatizing them to procedures and protocols through simulation-based learning.

Changes to the Project

There was a major delay in implementation as the work stoppage in fall 2017 prevented faculty from contributing to the project. After the stoppage, it was a challenge to find interested faculty to integrate the Labster modules into their learning activities.

In April 2018, two faculty members were identified and the entire implementation of the project was changed from its original scope, with only a meiosis lab being used for the BIO1010 course offering.

Team Description

The project team comprised the following:

- **Chair of Academic Upgrading:** This role was influential as this individual assigned the task of integrating Labster into the course material to part-time staff when no full-time staff had the capacity to do so.
- **Pre-Health Sciences faculty:** Two part-time faculty were exceptional in the process of re-evaluating the labs that were available and integrating them into their course material. Furthermore they provided the students with the support necessary to use the tool in class, and they were the primary point of contact for the project lead.
- **Project lead:** The project lead provided faculty support and training to ensure seamless implementation to the class. This role also provided video recordings to faculty to distribute to students.
- **Planning and Research staff:** The Planning and Research department generated and distributed the final survey to all of the students that participated in the lab.

Integration Details

We chose to integrate a meiosis simulation into our assessments, allotting 5% of the student's grade for completion and accuracy of answers. Students (approximately 80) enrolled in the January intake of Pre-Health Science Pathways (PHPG) were impacted by the simulation pilot.

We found that the learners used skills and materials from our course outline for BIO1010 Chapter 6–Genetic Inheritance, and specifically, the following outcomes:

1.4 – Discuss Gregor Mendel's experiments and contributions to the field of genetics.

2.0 – Discuss common single-gene human genetic disorders.

2.1 – Define polygenic and monogenic diseases.

2.2 – Describe chromosomal, environmental, single-gene and multi-factorial birth defects.

2.3 – Discuss dominant vs. recessive birth defects.

9.7 – Describe the process of meiosis.

9.8 – Discuss general prenatal development from fertilization to birth.

The students were able to demonstrate cooperation in group settings, problem solving, and computer skills during the simulation as well taking knowledge from the classroom and applying it to a simulation of two parents going through in vitro fertilization.

Benefits and Challenges

Benefits:

- The virtual lab was very interactive, allowing students to be more engaged with course material.
- The simulation was easy to use
- Setting up and registering students was simple.
- The simulation was very detailed and followed standard laboratory procedures.
- Directions were fairly clear and easy to follow.
- Resources and reference materials were provided in the simulation to support learning objectives.
- Information was accurate and concise.

Challenges:

- Most simulations were too advanced and did not correspond with the PHPG course outline, making it difficult to integrate the labs into the course.
- The entire simulation had to be run, as there was no way to remove or choose certain slides. Being able to remove slides that do not correspond to the course content would make it easier to incorporate more simulations into the course.
- Most simulations were very long (sometimes up to 240 steps).
- Simulation on meiosis referred to a Down Syndrome baby as being “not normal,” which was questioned by some students. It would be advisable to use terms such as “unhealthy” embryo instead of referencing terms of normality.

User Experience

Two educators used the virtual labs and implemented them in their BIO1010 course. The virtual lab was used for a two-hour assessment with 70 students participating. Students were placed in groups of three in a computer lab to complete the virtual simulation.

Any technical problems or difficulties were easily handled (e.g., setting up the simulations, registering students for the simulations) and the platform was found to be quite user friendly once the proper input settings were applied to the program. With this support, students did not seem to experience any technical issues gaining access to the virtual lab.

Value

After completion of the course, students and faculty completed a survey of the usability and effectiveness of the simulations.

From the student group, only three responded, leaving us unable to draw any statistically relevant conclusions from the survey on the student perspective.

Future Plans

At this point there are no plans to integrate Labster's virtual lab simulations into the curriculum at Cambrian College.

Canadore College

Project Description

The proposed virtual lab simulation project involved the integration of selected virtual lab simulations into relevant biotechnology courses. Currently, courses are delivered face-to-face and employ an online learning platform that houses course content. Within the program, some courses have lab components, whereas others are strictly lecture based. Biotechnology program learners are diverse and come from a range of backgrounds, including high school, university, and the workforce. The learning environment consists of small class sizes (under 20), an average of five contact hours per day, and a balance of individual and group-based work assignments.

The development phase of virtual lab integration occurred during the August 2017 preparatory period, and delivery occurred in a course-specific manner depending on scheduling. Courses selected for integration of the virtual lab simulations occurred during the fall and winter semesters. Integration of the software into lecture-based courses exposed students to course material in a hands-on manner, whereas integration into lab-based courses exposed students to techniques that are not able to be performed in the actual lab due to infrastructure and/or time limitations.

The project was deemed successful in one respect: it is compatible with course material and existing course delivery strategies (i.e., it can be delivered using the existing online learning platform). However, the faculty within the program area determined that the Labster product was not ideal in their courses for a number of reasons that were identified specifically in responses to eCampusOntario's survey.

The college academic year was atypical, being complicated by a faculty strike, and it is difficult to know for certain if the project outcome was impacted by that circumstance.

All faculty engaged in the project have said they would not likely use the virtual simulation software for their courses in the future.

The main success was that faculty became aware that there are other options available when hands-on, real labs are not possible.

Team Description

The implementation team consisted of three faculty members (two full-time and one part-time)

of the Biotechnology department at Canadore College. The full-time members are current and former published researchers in the fields of education biomedics. Each member of the participating faculty implemented a minimum of one Labster lab into their fall and winter semester course loads. The Labster activities were implemented through the College's online learning management system (Brightspace by D2L). For the initiation of the project, the students were guided through the activities by the faculty members via in-class discussion and computer lab assistance.

Initially, communication with other faculty at the institution was to have consisted of regular professional development workshops occurring throughout the academic year. However, given the work stoppage, Reading Week in the fall semester was cancelled, and during the winter semester PD Opportunities Week, the institution chose to deliver a simplified calendar. Presentation of the Labster software to the broader college community did not occur.

Communication with Labster was via email and teleconference, in addition to the training webinars, as necessary. The learners participating in the project had access to the online learning management system (LMS) and computer labs at Canadore College as well as regular debriefs by the faculty of the department. The use of surveys and data-gathering techniques allowed the faculty and Labster to assess the impact on engagement and median class grades compared to historical data in the LMS.

Integration Details

This section includes responses to the question on integration from each participating faculty member.

PT Instructor

BTN110–Organ Physiology. Three virtual labs were designated as required assignments, each worth 5% of final mark. The virtual labs were chosen to provide a laboratory example to support body systems covered in the lecture-based class. This is a first-semester course, and students (n=19) liked the idea of being exposed to a lab setting. Overall students liked having the theory portion of the lab available so they could go back to it any time to reread information in order to answer the corresponding lab questions.

BTN455–Virology. One virtual lab was assigned to students (n=12), worth 5% of their final mark. Although this lab did not explicitly deal with viruses, it allowed students the opportunity to understand the basics of cell culture. BTN455 is a lecture-based course, and this allowed for a virtual lab experience. Students overwhelmingly did not like the virtual lab. There was a verbal appreciation for the theory covered in the lab, but they found the simulation too automated.

FT Instructor 1

In the second semester of the pilot program with Labster, two courses were used to experiment with Labster as a learning platform:

- BTN215/230–Organic and Biochemistry, second-semester students (13 enrolled).
- BTN 435–Proteomics, fourth semester students (14 enrolled).

Each of the cohorts was presented with varying numbers of simulations (three for BTN215/230 and four for BTN435) to support curriculum delivery (BTN215/230) and enhance the laboratory experience (BTN215/230). The students in each cohort were offered a bonus of 5% to 10% to participate in the simulations and the assessment survey.

Looking at the breakdown of the cohorts individually:

- BTN215/230 students participated at a rate of approximately 50% in the second part of this pilot program. The chosen simulations for these students were Introduction to Food Macromolecules; Protein Synthesis; and Protein Denaturation. Each of the participants reflected on the experience through the use of a survey.
- BTN435 students participated at a rate of about 50%. There were four chosen simulations reflecting the curriculum of this non-laboratory based course: HPLC, NMR, Mass Spectroscopy, and Enzyme Kinetics. These student participants were also asked to reflect on the experience through the use of survey tools.

FT Instructor 2

Table 13.1 summarizes the integration details for my four courses.

Course	Semester	Simulation name:	Number of Educators	Number of Learners
BTN100 Cell Biology	1	Cellular Respiration	1	16
BTN405 Molecular Biology	3	CSI Lab & Molecular Cloning	1	12
BTN131 Genetics	2	Meiosis & Mendelian Inheritance	1	16
BTN310 Industrial Microbiology	4	Fermentation Lab	1	13

Table 13.1 *FT Instructor 2 Integration Details*

Integration into the Curriculum

For each course, students were instructed to complete the virtual simulations individually during

their own time–not during scheduled lecture or lab times (fall semester courses: BTN100 and BTN405), or during scheduled independent lecture time (winter semester courses: BTN131 and BTN310). Instructional help was available (although not used) remotely.

For lab-based courses (BTN100, BTN405, BTN310) the goal in using the virtual simulations was to provide contextual information for techniques not yet performed in the lab. Students were required to complete the selected simulations as a prerequisite to conducting the lab on site. This strategy was intended to benefit the students by providing them with a self-guided review of the techniques prior to applying them in the lab. For BTN100 and BTN405, completion of an evaluative summary contributed up to an additional 5% on final test grades, and for BTN310, students who were able to complete the assigned simulation by the due date and time were given a 5% bonus on the associated test (test 2).

For the theory-based course (BTN131), prior to being assigned the virtual lab, learners were introduced to the theory in class and had already completed a graded review assignment on the topic. The simulation was assigned to reinforce what was covered during lecture and assessed as part of the written assignment. Following the simulation, students completed a quiz, which applied the concepts covered. Students who were able to complete the assigned simulation by the due date were given a 5% bonus on the associated quiz.

Learning Outcomes Supported and/or Met by Simulations

The primary goal in using the virtual simulations in my courses was to reinforce important theory-based concepts. For each course, the concepts supported or linked directly to the learning outcomes outlined in the course syllabus, as specified below:

- BTN100: Cellular Respiration simulation directly linked to specific learning outcome 4.4. (Identify and describe the reactions involved in cell respiration in theory and in the lab.)
- BTN405: CSI Lab and Molecular Cloning simulations supported learning outcome 6.0. (Perform some of the major experimental techniques used to manipulate DNA in the laboratory.)
- BTN131: Meiosis simulation directly linked to specific learning outcome 1.5. (Describe eukaryotic cellular reproduction, and differentiate between mitosis and meiosis.) Mendelian Inheritance simulation supported learning outcome 2.0. (Apply Mendel's Laws via the analysis of human pedigrees and the use of probability calculations/measurements.)
- BTN310: Fermentation lab simulation supported learning outcome 2.0. (Categorize the beneficial uses of microbes [use of microbes in recombinant DNA technology] in the pharmaceutical industry.)

Benefits and Challenges (Educator Perspective)

Benefits: The simulations provided the learners with an additional tool for learning key concepts. This enhanced theory added variety to the learning materials made available to the students. In addition, the simulations exposed the students to selected lab techniques that are otherwise not able to be demonstrated due to limitations in the tools/materials/equipment available on-site.

Challenges: Student engagement was a challenge. Giving the learners an incentive for completing the simulations (i.e., bonus marks) helped to increase participation.

User Experience

The pilot project had three educators working on the integration of simulations in multiple courses of the biotechnology program.

The project consisted of two halves: the first half consisted of students in the first and third semesters of the program and the second half consisted of students in the second and fourth semesters of the program.

PT Instructor

- BTN110: Three virtual labs were used throughout the semester. In general, the students like the virtual labs. Some suggestions for improvement were to have the option of the lab reading the information to the user (i.e., text to speech). Students prefer to have the information read to them, but some students really disliked having it read to them. Students using Mac computers also said that the Labster drained their laptop batteries quite quickly. As well a few students had difficulty getting their account set up and/or having the program stall and/or glitch.
- BTN455: One virtual lab was used during the semester. In general, the students disliked the virtual labs. Verbal responses to questions about the labs included an appreciation of the theory involved, but dislike of the computer-generated voice and repetitive actions.

FT Faculty 1

The assessment of the students and simulations that I was responsible revealed that there was initial excitement about the use of virtual simulations, but that excitement waned significantly in the second half of the program. The loss of enthusiasm is reflected in the surveys, as six of the seven second-semester students comments on the lack of “real” skill learning using simulations compared to the use of laboratories. The fourth-semester students were already overwhelmed with capstone projects as part of the program and felt that, although the simulations were interesting, provided little in the way of curriculum support to enhance completion of those projects.

The simulations themselves are very well synthesized and presented on the part of Labster, but it was difficult to directly align existing course curriculum with the virtual simulations without having to rewrite some of the curriculum in a condensed semester.

FT Faculty 2

For my four courses, I was the only educator, and in total, there were 16 first-year students and 13 second-year students involved during the evaluation period.

Each virtual lab was assigned once.

Likes: Based on written feedback, learners found the simulations enjoyable, relevant, and educational. Many commented on their overall strength as a learning resource. Specifically, students found that the simulations addressed different learning styles through auditory and visual descriptions, and that they provided a good alternative to on-site labs through the provision of extra practice and exposure to new techniques. The convenience of being able to interact with realistic lab procedures remotely was also highlighted, and the content was generally viewed as relevant to the associated course material. Finally, some students specified that they liked the quizzes and that the platform provided feedback and allowed for multiple opportunities to answer questions correctly.

Dislikes: Many students found the simulations to be tedious and time consuming with respect to the precision with which they were required to navigate through the visuals. Individual learners specified that instruments were difficult to find, some actions were not responsive, and that the interface was too sensitive to cursor placement, all of which impeded progress. In addition, some learners indicated that the procedural steps were not always clear, which created confusion. Other dislikes included online learning in general, and the audio used in selected simulations, which mispronounced key scientific terms (e.g., “de-na” for DNA).

Technical issues: Many learners reported glitches that prevented them from being able to complete the simulation unless restarting. The simulations reportedly did not work on all monitor widths, which required students to restart on a different computer. Other complaints included a long load time, and that the simulations drained laptop battery.

Support: Extra support was not accessed during the evaluation period; however, the initial orientation was useful, and the eCampusOntario team ensured that educators and learners were aware of, and had access to, technical support if required.

Value

PT Instructor

- BTN110: An online survey was conducted at the end of the semester using our online learning management system, D2L.
- BTN455: A verbal question-and-answer period about the student experience was conducted after the students completed the Labster.

FT Faculty 1

In both the first half and second half of the pilot project, first- and second-year students were assessed by survey on our in-house learning management system (D2L). The first half results were submitted as part of the interim report.

For the second half of the pilot project the same survey approach was taken with the participants. The main personal goal for this educator was to assess the student's opinions on whether the virtual simulation was comparable to the actual laboratory experience, whether the simulation reinforced the curriculum content, assessing the quality of the virtual simulations, and determining the student opinion on simulations as a learning tool for science.

The second half of the pilot had significantly less participation than the first half, even with an equal added bonus participation mark. Overall, the students did enjoy the visual nature and individual time to participate. The consensus was that the virtual simulations did not compare in direct impact to learning as did the actual laboratory experience. This was consistent with both the second- and fourth-semester participants. They did comment that they were able to reference the course curriculum when completing the simulation, but, there was only modest overlap between the course curriculum content and the objectives of the simulation labs. The student participants did like the quality of the simulations; there were very few comments about the difficulty of the actual mechanics of the simulation. They felt that it was a reasonable tool for achieving learning objectives but felt that they would achieve more if doing more actual laboratory work.

Reflecting on the experience I would say as an educator that the experience was not terribly exciting. It provides little opportunity for actual physical training and preparation for working in a standard laboratory environment. I would probably not elect to use the virtual simulations further as part of my course delivery.

FT Faculty 2

For the fall semester simulations (CSI Lab, Cellular Respiration, and Molecular Cloning), students completed a voluntary evaluative written summary. They were asked to submit a short (one-paragraph) evaluation on their experience using the virtual simulation. They were asked to include the following in their evaluation:

- What they liked about the simulation and learning platform.
- What they disliked about the simulation and learning platform.
- What they would change about the simulation and/or learning platform.

- Overall contribution to their learning with respect to the course content.

A descriptive analysis was completed on written responses (n = 17). For each of the four outcomes outlined above, meaning units (MUs) were identified and grouped into themes. Based on the themes, analytical categories were generated, and each MU was recoded with the appropriate response categories for descriptive analysis. Multiple MUs were generated from each response, and MUs that fit into more than one category were coded and analyzed as such. (Please see Appendix D for details.)

These results will be made available to the college community upon request.

Future Plans

PT Instructor

I do not plan to integrate virtual labs into my curriculum as students prefer to have physical hands-on labs. Although the first-year students thought the labs had some value in supporting theory and allowing them to experience a lab setting, by the second year the students overwhelmingly did not see the value in the virtual labs.

FT Faculty 1

Personally, I have seen no additional benefit to using the virtual simulations in my curriculum. I do not believe that they have given support or reinforcement to the student as part of the learning experience. I am not electing to use the virtual simulations as part of my course delivery in the future.

FT Faculty 2

There are currently no plans to continue integrating these virtual simulations into the existing curriculum. Although most learners indicated that the simulations helped with retention and understanding of course material, the written and verbal feedback also indicated that the simulations were overall too time consuming.

In light of their relevancy and educational integrity, these simulations have potential to serve as alternatives for missed labs in the future. In order for this to be feasible, there would need to be additional simulations available so that more on-site labs (ideally all on-site labs) could have a corresponding virtual option.

Lessons Learned

Lessons Learned

PT Instructor:

- Students are more likely to complete the lab if they are given a specific time frame in which to do so. As well, by assigning marks to the lab students feel the labs are an important part of the curriculum. These simulations are best geared to first-year students who do not have much experience working in a laboratory setting.

FT Faculty 1:

- I would say that in order to use the virtual simulations effectively as part of course delivery, the educator is going to have to pay attention to aligning the course curriculum content to mirror the objectives of the simulations very closely. Unless there is a direct requirement for participating and completing the simulations, students lose interest in the simulations as the novelty of the activity wears down. It becomes just another activity for completion.
- If a course) were designed around the use of the virtual simulations (being central to learning outcomes) there is a greater chance for incorporation and success.

FT Faculty 2:

- Associate completion of the simulations with a grade.
- Dedicate instructional time to the completion of the simulations.
- Ensure that the simulations are adding some additional educational content for the learner, rather than simply reinforcing concepts that have already been covered.

Centennial College

Project Description

Centennial College identifies eight strategic goals as articulated in its Book of Commitments. One of the goals is to "offer the map and the compass" which, in part, entails "leveraging technology tools to design, deliver, and manage learning."

Centennial College's Applied Biological and Environmental Sciences (ABES) programs (e.g., Biotechnology, Medical Laboratory Technician, and Environmental Technician) are therefore exploring ways in which educational technology tools may be integrated in order to provide a technology-enhanced learning environment. Based on what we learned through the webinar from eCampusOntario, and after consultation with the college's instructional design team, we believe that exploration of Labster virtual simulations offers promise in this process of course modality redesign.

This report describes the pilot phase of the project that is focused on investigating the effectiveness (in terms of delivering specific learning outcomes, and also engaging and motivating students and teachers) of Labster virtual simulations in the ABES department at Centennial College.

Although several courses exist within ABES programs for which virtual simulations could be relevant, the BAM-108-Biological Techniques course was proposed for the Labster pilot. This introductory-level course was designed to have students acquire basic knowledge of techniques used in microbiology laboratories.

In order to assess the utility of the Labster, four virtual simulations were introduced in BAM-108 laboratory settings in the fall 2017 semester. Following this, the faculty team, in consultation with the curriculum and instructional design analyst, explored ways in which the virtual lab simulations can be integrated into the course. In this case, "integration" was explored in multiple contexts, particularly in how the Labster simulations may complement, augment, and/or substitute for curriculum presented in the course. The perceived and actualized "effectiveness" was assessed (as measured through student surveys, assessment scores, and instructor's reflection on the experience with Labster).

Analysis of the feedback has shown that integration of Labster virtual lab simulations with BAM-108 did not fully meet the course and program learning outcomes. Consequently, the course was removed from the project and the new CH-222 (Biochemistry 1) course was proposed to pilot Labster virtual simulations in the winter 2018 semester, which the teaching faculty agreed may be effective for promoting student learning. In the summer 2018 semester, the process for curriculum integration of Labster virtual simulations was developed. As of fall 2018, three Labster virtual simulations have been fully integrated into CH-222 course.

Our findings suggest that Labster virtual learning simulations may enhance student learning and can be used as supplementary educational methods.

Team Description

To maximize the opportunities for success of the virtual simulations project at Centennial College, faculty members, in consultation with a college instructional design analyst and Labster specialists, explored ways in which the simulations could be integrated into two courses in the Biotechnology and Food Science Technology programs in the 2017–18 academic year. The working team of the project is presented in Table 14.1.

Identity	Role	Institution	Responsibilities
Steve Bouloudakis	Project Lead, Chair	Applied Biological and Environmental Sciences (ABES) Centennial College	Administrative supervision and coordination of the project
Greg Atkinson	Curriculum and Design Analyst	Centre for Academic Quality, Centennial College	
Marina Ioselevich	Professor and Co-Project Lead	ABES, Centennial College	
Fouroozan Mohammadi	Professor	ABES, Centennial College	
Sam Butcher	Customer Development Manager	Labster	Point of contact for the Labster team and Centennial College team
Emma Durand	Customer Success Specialist	Labster	

***Table* 14.1:** *Project team and responsibilities*

The project team remained in a constant state of communication via face-to-face meetings, email, and telephone calls (see Table 14.2) to identify courses within ABES programs for which virtual simulations may be relevant, any need to retool and redesign curriculums of those courses, how to integrate Labster simulations into teaching strategies, and to gather evaluative data and student feedback.

Date	Audience	Objective	Format
September 2017	All project team members, eCampusOntario	Introduce project members, Review objectives and goals	Face-to-Face meeting, webinar
September 2017	All project team members		Face-to-face meeting, email, conference call
November 2017	All project team members	Discussion of project progress	Face-to-face meeting, email, conference call
December 2017	All project team members	Discussion of project progress, students' feedback and plans for winter 2018 semester	Face-to-face meeting, email, conference call
January 2018	Project lead, Centennial College project team		Face-to-face meeting
January 2018	All project team members	A mid-term evaluation of the project	Face-to-face meeting, email, conference call
February 2018	All project team members		Email
March 2018	All project team members	Discussion of project's progress, students feedback and plans for summer 2018 semester	Face-to-face meeting, email
April 2018	Project lead, Centennial College project team	Assessment of impact	Face-to-face meeting
May 2018	Project lead, Centennial College project team		Face-to-face meeting
June–August 2018	All project team members	Discussion of project progress, assessment components, student feedback on Labster labs in CH-222 course	Face-to-face meeting
September 2018		Evaluation of the final phase of the pilot virtual simulations project	Face-to-face meeting

***Table* 14.2:** *Project Communications Matrix*

Integration Details

Faculty members participating in the project represented two courses in the Biotechnology and Food Science Technology Programs. Table 14.3 provides the details.

Course	Evaluation Period	Class Size	Faculty
BAM-108	September 2017–January 2018	23	Marina Loselevich
CH-222	January 2018–April 2018	325	Fouroozan Mohammadi
CH-222	May 2018–August 2018	150	Fouroozan Mohammadi

***Table* 14.3:** *Class size and faculty members and participating in the project by course*

In the fall 2017 semester, four virtual simulations were introduced in BAM-108 laboratory settings. BAM-108-Biological Techniques is a one-hour, very intensive in-lab hands-on course where the students acquire expertise in methods such as streak plate, decimal dilution, enumeration by pour and spread plate, differential and structural staining, and microscopy. Labster virtual laboratory simulations were used as a pre-lab exercise. Students completed the simulations individually prior coming to the class.

In the project meeting in November 2017, the instructor teaching BAM-108 course shared her observations of her experience with Labster virtual simulations. Examples of the most apparent benefits of using Labster simulations as an instructional tool include:

- The online format of the virtual simulations makes it accessible to all students, including those who require more flexible schedules.
- Online virtual lab simulations help students understand the theory and complex science concepts.
- Virtual simulations test ability to troubleshoot experiments, interpret results, and use critical thinking.
- Online virtual labs allow students to repeat the experiments as many times as they wish; they include simulators, theory, and a mandatory post-simulation quiz.
- Virtual lab simulations allow students to finish the wet lab experiments faster than without virtual labs.
- Labster Teacher Dashboard provides summary statistics on students' overall performance in every undertaken simulation lab.
- Labster support specialists provide 24/7 technical support for instructors and students.

Benefits highlighted by the instructor, the quality of the students' results, and responses to the post-simulation survey all demonstrate that Labster virtual lab simulations may be effective tools for promoting student learning in BAM-108 laboratory settings. However, virtual lab simulations cannot replace time at the bench and hands-on practical activities needed to develop students' practical skills, and therefore do not fully meet the main BAM-108 course learning outcomes and course assessments and do not match integration goals for students' learning benefits.

In a December 2017 meeting, the project team members shared their observations, insights, and accomplishments with Labster virtual simulations integration. Based on feedback obtained, a decision

was made to remove BAM-108 from the project, and the new CH-222-Biochemistry 1 course was proposed to pilot Labster virtual simulations in the winter and summer 2018 semesters.

Starting in the winter 2018, CH-222-Biochemistry 1 was offered in a blended learning format: one hour per week of online learning, two hours per week of face-to-face lecture, and two hours per week of traditional hands-on laboratory training. The online portion of the course is asynchronous, which means that students can complete this part of the course at a time that is convenient to them, but before the assigned deadlines. In this course, students are introduced to the theoretical and practical application of biochemistry. The theory focuses on the most important molecules found in living systems from nucleic acids to proteins, carbohydrates, lipids, and enzymes. Theory concepts are applied and explored by students in the lab.

Given this focus, three virtual simulations were integrated in CH-222: 325 students completed the lab simulations in the winter 2018 semester, and 150 in the summer 2018 semester. Labster virtual simulations were integrated into online learning modules, linked to face-to-face lectures as a complementary learning tool, and used as a pre-lab exercise. Students completed the simulations individually prior coming to the related lectures or lab sessions. Virtual simulations were integrated as a graded element into the course, which caused minor modifications and adjustments of a grading policy in the syllabus.

The overall impact of Labster virtual lab simulations on students' learning in CH-222 was discussed during the monthly project meetings (see Table 14.2). The faculty team highlighted the following potential benefits and advantages of integration of Labster virtual lab simulations with CH-222 beyond those indicated for BAM-108:

- Labster simulations include theory components and animations that are linked to complex topics covered in face-to-face lectures and lab experiments in CH-222.
- Labster simulations allow for demonstrations of structure, mechanisms, and techniques to observe otherwise unobservable biochemical phenomena and thus help students to develop an understanding of concepts and processes.
- Visual lab simulations can be connected to course assessments and in-lab and in-lecture course activities.
- Every Labster virtual lab simulation includes built-in, multiple-choice questions accompanied by immediate personal feedback to the users. This form of assessment gives students the opportunity to reflect on what they've learned;
- Integration of Labster simulations in curriculum helps in assessing the engagement and progress of students.

However, the project team members raised a number of concerns about Labster simulations integration:

- Most Labster virtual simulations were developed for universities rather than colleges.

Instructors have been unable to find level-appropriate simulations for courses.
- The multiple-choice questions embedded into every simulation cannot be modified by the teaching faculty to establish stronger links between course content and learning outcomes.
- Virtual simulations may discourage transferrable skills development; namely, the ability to work collaboratively in teams and to influence others, as well as direct interaction among teachers and students.
- There is a lack of linking between Desire2Learn (D2L) Learning Suite and Centennial College's learning management system (LMS), and Labster VR platforms makes CH-222 course administration time consuming.
- There are additional costs associated with the integration of Labster virtual labs in CH-222 upon completion of the pilot project.

Overall, implementation of three Labster virtual simulations was found to be aligned with CH-222 course design. The project team members agreed that the piloted Labster virtual lab simulations could be integrated with CH-222 to extend lectures, to complement course assessments, and to provide students with virtual tools, materials and lab sets in order to perform experiments at anywhere and anytime.

User Experience

Labster provided 250 free licences to be used in the 2017–18 academic year in the pilot project. Due to the high number of students taking CH-222, an additional 250 free licences were kindly provided by Labster to be distributed between the winter 2018 and summer 2018 semesters.

The students and instructors received ongoing adequate and prompt technical support and training in the use of the Labster virtual simulations to overcome all initial difficulties. The only technical issue experienced during the evaluation period was the lack of linking between D2L Learning Suite and Labster VR platforms. Integration of Labster VR platform with D2L could provide access of Labster virtual content directly in the D2L course shell, making delivering of the course resources more convenient, saving time spent in course administration, and helping instructors and Labster create an even better course experience for students.

Value

After completing each simulation students were asked to participate in formal post-simulation survey about Labster's impact on their learning. Results of a survey show that students expressed favourable views of the virtual experiments.

As shown in Figure 14.1, the students participated in the survey 1123 times in total (students could participate in the survey each time they play a simulation) and more than 90% of the students were positive about every aspect of Labster virtual simulations. Responses indicated that students "gained relevant knowledge by using the simulations," "feel more confident about lab skills after the simulation," "feel that they can apply what has been learned in the simulation to real world cases," "found the simulation motivating," and were "pleased with simulation overall."

In addition, the students shared their informal feedback and thoughts with their instructors during and after the completion of the courses. The students thought Labster simulations were aligned with course learning outcomes and very helpful as supplementary resources, lecture substitutes (online learning modules), and pre-lab exercises. The students commented that Labster virtual lab simulations:

- Would be a fun time for them to learn the course key concepts.
- Allow them to visualize complex chemical structures, functions, or mechanisms.
- Give them the possibility of replaying and watching the process as many times as they needed until they've mastered it.

BAM-108 Course: Sample Size = 81

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=49

CH-222 Winter 2018 Course: Sample Size = 687

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=49

CH-222 Summer 2018 Course: Sample Size = 355

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=49

***Figure 14.1:**. Students level of agreement with five positive affirmations about Labster's impact on their learning*

In May 2018 Labster was introduced to the ABES departmental community. Thirty faculty attended the presentation by Centennial College project team members F. Mohammadi and Dr. M. Loselevich, who shared their observations, thoughts, and accomplishments with Labster virtual simulations integration in CH-222 and BAM-108.

Future Plans

CH-222-Biochemistry 1 will continue to integrate Labster virtual lab simulations. Students need to purchase access to three Labster virtual simulations requested as part of curriculum.

In future, we hope to gather more in-depth opinions from instructors and students in order to better assess and develop our students' employability skills, and to meet the program and course learning outcomes through Labster virtual laboratory simulations. Further work is required in the curriculum design and technical integration support to incorporate collaborative assignments that may enhance students' learning and transferable skills. We are actively pursuing a number of ways to continue the progress achieved thus far.

Lessons Learned

Lessons Learned

Over the three semesters, faculty team observed positive impact of Labster virtual lab simulations on students' learning processes and level of engagement. Interactive simulations may provide an opportunity to achieve greater learning gains and motivate students. The main lessons we learned include the following:

- Having good collaboration between the Centennial College team and Labster team was instrumental to project success.
- Project meetings helped the project team to identify essential student learning, analyze current levels of achievement, set achievement goals, and then share strategies to improve upon those levels.
- Active student participation and reflection on the experience with Labster facilitates implementation of the virtual laboratory simulations into teaching strategies is valuable.

- The project needed better ways to measure project outcomes.

Durham College

Project Description

The project was attractive to us, and we ran virtual simulations in our program for the first time the 2017–18 academic year. With the launch of our new program (Pre-Health Sciences), wet labs are a requirement for in-class students. We also have an online stream of this program and were looking for a "one-stop shop" for biology virtual simulations.

The vision and goal were to create a virtual environment for online students where they get the experience of a lab environment similar to what our in-class students might experience.

From the faculty perspective, the project was successful. Student feedback throughout the project was positive in many regards (Labster customer support, ease of use, look and feel of the interface).

Some areas of growth include adding more topics. Our students had to do a meiosis lab because that was the only one available, even though this lab did not necessarily fit as well with our course learning objectives. Also, anatomy is a large part of the second-semester biology course, and there are no anatomy-related labs.

Overall the user experience was a smooth process. One instructor experienced an issue with a student signing in, but there was excellent and responsive customer support from Labster. In general, students had few technical issues.

Team Description

The virtual simulations project was managed by the online biology instructors. Communication and collaboration with the larger Pre-Health Sciences program team happened at meetings, through email, and in informal, anecdotal conversations. Strengths and weaknesses were also informally communicated to administration as we consider how we want the use of virtual simulations to be incorporated in future (e.g., use only one resource like Labster or draw from a variety of free online resources).

As this was the first year of the program launch and the first program experience with virtual simulations, learners were frequently asked for feedback about their experience. This happened multiple times throughout their first- and second-semester experiences with Labster. This feedback was also informally communicated to colleagues.

Integration Details

For the duration of the virtual simulations project, two instructors and approximately 90 students were involved. Labs were chosen to align with course learning outcomes. Unfortunately there were gaps in finding a virtual simulation that aligned with our course learning outcomes, and at times students had to be provided additional information not relevant to our course in order to complete a lab.

From the learner perspective, the learning skills supported included organization, following instructions, and performing labs using appropriate techniques. While there are some skills demonstrated in a wet lab setting that cannot be covered with a virtual simulation (e.g., tactile skills), the virtual simulations met several of the intended competencies and learning outcomes of our introductory biology course.

From the educator perspective, the largest issue experienced was finding labs that connect to our curriculum. Lab content was at times too advanced for our students, but we balanced this against the high quality look and feel of a real lab offered through the simulations. Labs could not be modified, so there were times when content was introduced that was not part of our course learning outcomes. Also, on occasion the virtual simulations did not supplement or enhance the curriculum. This could be problematic as we are a preparatory program and students need to be prepared with the content and skills required for their further studies.

User Experience

The virtual labs were used five times throughout each semester. At completion of the certificate program, students would have finished 10 Labster virtual labs.

Feedback on both the student and instructor user experience was very positive. The instructions provided for faculty were very user friendly, and Labster was always quick to reply to emails and was very helpful in providing guidance. Students were able to register for and access labs easily. Instructor support was also high quality, but it should be noted the Labster website could be more intuitive.

Value

Three surveys were administered to students throughout the project time frame. The surveys included questions such as:

- Did you have any issues with the simulation? If you had issues, did you contact the instructor

and get the issue resolved?
- How much did you learn from the third Labster simulation?
- Did you enjoy the third Labster simulation?
- How can your experience with the simulation be improved in the future?

Student responses to the above questions were positive, including comments on the platform and overall user experience. One student noted a dislike for performing actual labs and much preferred a virtual lab option.

Results of these surveys have not yet been communicated to the team, but will be after the current semester finishes.

Future Plans

We have plans to use Labster for the 2018–19 academic year in all online Pre-Health Sciences Biology courses. We will continue to reflect on the effectiveness and fit of Labster for our course needs. In the 2017–18 academic year we used five Labster labs each semester. In the upcoming academic year we are increasing this to six Labster labs each semester.

For Labster to be most effective for our students and a good fit for our program outcomes, we need more variety and more entry-level biology concept-based simulations.

The online program also has a chemistry course but a different virtual simulation provider is used. We find Labster very limited in its chemistry offerings, and of the chemistry labs available, none of them are at a level required for our students and they do not align to the chemistry course learning outcomes.

In general, the look and feel of the Labster interface seems like it is preparing for students to work at a lab bench. However, our students go onto clinical settings (e.g., RPN, RN, para medicine) and could benefit from more anatomy and physiology-based experiences.

Lessons Learned

Lessons Learned

- You need to be aware and clear on why you are integrating virtual labs and how they connect to your learning outcomes.
- Virtual labs are great but they do not address all skills and knowledge obtained from an actual lab experience.
- It's important to refer closely to your course learning objectives when selecting a virtual simulation.

Lambton College

Project Description

The primary goal with the simulations is to increase engagement of the students and see an increase in their performance in lab exercises. Originally, it was planned to use the simulations as a pre-lab exercise worth 5% of the students overall lab grade. This was changed to a 3% bonus exercise as a result of the faculty strike and condensed winter schedule. As a result, comparisons with previous lab groups were not compiled. However, the project is considered successful since the majority of the feedback from the students who participated was positive.

Team Description

The team was made up of Emma Durand (head of Customer Success) and Samuel Butcher (scientific collaboration specialist) at Labster and Margaret Carter and Chuck Ewart at Lambton College. Chuck Ewart set up the Labster simulations and Design2Learn (D2L) surveys. Chuck communicated with the instructors and students via the message feature in Labster as well as D2L news items. Chuck visited each lecture section to communicate what was required of the students in order for them to complete the Labster simulation and the associated D2L survey. Chuck also answered students' questions and directed them to the Labster team for technical inquiries.

Integration Details

The students were asked to complete the simulations before each associated lab and participate in the D2L survey. There was one instructor (Chuck Ewart) and 100 students in the 2018W CHM-2106 lab course. The students were asked to complete the simulations as a bonus experience. The majority of the students who participated favoured the Labster experience.

User Experience

One educator (Chuck Ewart) participated, along with 22 students in Titration, 19 in Acids and Bases, and 19 in Equilibrium. The virtual labs were used three times. The majority of students responded

"completely agree" or "mostly agree" to the D2L survey statements (see the statements in the next section, below), indicating that they liked the virtual labs. Students with technical issues were sent to Labster technical support. Generally, the overall experience with training, orientation, and support for the virtual labs was positive.

Value

D2L surveys were set up for each of the three simulations. Eleven statements were chosen with response choices ("completely agree," "mostly agree," "mostly disagree," and "completely disagree").

The statements and responses were modified from a journal article by Bonde et al. (2014):

1. I was satisfied with the overall experience of this simulation.
2. It is a good idea to use Labster before using a real laboratory.
3. I would like Labster to be used more in teaching.
4. Labster can be a good supplement to regular laboratory teaching.
5. I learned something for the laboratory by using Labster.
6. Labster is more motivating than ordinary pre-lab exercises.
7. Labster makes course content more interesting by working with practical examples.
8. The experience with Labster inspired me to engage more with the laboratory.
9. It was interesting to use Labster.
10. I would recommend Labster to be used in the laboratory.
11. The following amount would be reasonable for Labster access.

The majority of students who participated favoured the Labster experience.

Future Plans

At this time, with uncertainty regarding pricing, there are no plans to integrate the Labster simulations into the lab curriculum. The overall student experience was positive indicating that Labster could be integrated; however, participation was less than desired. A full uninterrupted year would allow for better planning and implementation of Labster simulations and D2L survey results .

Lessons Learned

Lessons Learned

- Having an entire semester and the Labster simulations count as a graded item (and not a bonus item) would be useful in the future.

References

Bonde, M., Makransky, G., Wandall, J., Larsen, M. V., Morsing, M., Jarmer, H. Ø., & Sommer, M. (2014). Improving biotech education through gamified laboratory simulations. Nature Biotechnology, 32, 694-697. doi: 10.1038/nbt.2955.

Mohawk College

Project Description

We integrated four Labster modules into four courses: two in the fall and two in the Winter.

- Lab Safety Labster: Medical Laboratory Assistant (MLSC10012) fall 2017
- Microscopy Labster: Laboratory Basics for MLA (MLSC10013) fall 2017
- Intro Lab Labster: Transfusion Medicine for MLA (MLSC10018) winter 2018
- Hematology Labster: Hematology for MLA (MLSC10015) winter 2018

The intent was to integrate the modules into our learning management system (LMS), eLearn. However, we received the licences late in September and did not have enough bandwidth to have a full integration. We did not reach 100% compliance; however, we do feel it was still a success. During the fall 2017 semester, a province-wide strike occurred which negatively impacted total enrolment slightly.

The feedback we received from students was very positive and they have asked for more modules to be integrated into other courses to continue to enhance their learning experience.

Team Description

The team involved included faculty members, Continuing Education support, Program Advisory Committee (PAC) members, the senior leadership team (SLT), and our Centre for Teaching and Learning. Updates of the initiative were provided to our PAC and SLT during the scheduled meetings, and instructors were updated of new Continuing Education initiatives through email announcements. During this time we also had a program review where many of the students indicated that they wanted to receive more interactive modules like Labster.

Integration Details

We only had one faculty integrate Labster into four courses. We provided students a link in our LMS with instructions on how to access and set up a log-in. The program manager also emailed all the students with instructions. If a student had not created a log-in we sent out another notification.

The first two modules were linked to a grade and the last two were linked to questions within the final exam. We wanted to see what students responded to better. There was great uptake on the first modules related to grades, although there were some challenges from the faculty side with enforcing Labster as a requirement. The students who wanted engaging learning found the modules valuable.

User Experience

We had one educator and 32 learners who were provided with licences over the course of the two semesters. The only time the students did not complete the module was if they dropped out of the course (attrition). The learners did not like that the modules were not mobile friendly. There were a few technical issues, but the help provided by Labster was quick and responsive. The overall support was extremely helpful and improved the student experience.

Value

We surveyed the 32 students, but unfortunately received only four responses. We asked eight questions to determine the satisfaction of the students. We will share the responses with our PAC.

Future Plans

We are looking at integrating more modules into each course. For our Introduction to Medical Laboratory course we want to introduce lab safety and pipetting modules. In Chemistry, we would use Acid and Base, and for Microbiology we would use Microbiology Biosafety and Bacterial Isolation. We would look to achieve full integration into our LMS using the grade import port functionality as well.

Lessons Learned

Lessons Learned

- Creating content with the idea of using Labster from the beginning instead of piecing in components to fit would create a better experience for the students and faculty.

Sault College

Project Description

Sault College participated in the Labster Virtual Simulations Project because of the opportunity to evaluate the Labster simulations. Specifically, the simulations were evaluated as a potential solution to physical resource challenges that impact our delivery of the Pre-Health Sciences (PHS) program. Additionally, the simulations were evaluated on how well suited they are to online course delivery.

Sault College set out on this project with three primary goals:

1. Determine the suitability of Labster virtual simulations as a supplemental tool or replacement for chemistry laboratory exercises attached to the chemistry courses within PHS.
2. Determine the suitability of Labster virtual simulations as a supplemental tool to provide biology laboratory exercises that are otherwise unavailable in the biology courses within the PHS, due to a lack of biology laboratory access.
3. Determine the suitability of Labster virtual simulations as the laboratory substitute for a potential online delivery of the PHS.

The project was not a full success as we did not get the level of participation as planned. The work stoppage was the primary contributing factor for this. The courses where the Labster simulations were used or intended for use were all impacted by condensed total teaching time secondary to the strike. As a result, we only used the simulations in one of the chemistry courses. The students did provide feedback through a survey, and the chemistry professor provided a great deal of constructive feedback.

Team Description

Bob Chapman, chair of Health Programs:

- Led the project at Sault College.
- Worked with the professors in getting the Labster access and needed IT upgrades, and in providing the objectives of the project.
- Worked with project liaison, Emma Durand of Labster.
- Developed a survey to elicit student feedback.
- Participated in the meetings/webinars with eCampusOntario and Labster and submitted all necessary reports to eCampusOntario.

- Completed certain Labster Virtual Simulations.

Christine Giardino, chemistry professor:

- Completed the Labster Virtual Simulations that best related to course outcomes of PHS CHM191.
- Had students complete three of the Labster virtual simulations for CHN191 (Acids and Bases, Equilibrium, and Titration).
- Facilitated an end-of-semester feedback survey to students.
- Provided concise feedback from an instructor perspective.
- Participated in the final webinar on May 10, 2018.

Leslie Dafoe, biology professor. Pre-Health Sciences Program Coordinator:

- Completed the Labster Virtual Simulations that best related to course outcomes of the PHS BlOtQO course. (Further participation in the project was limited because of a leave of absence.)

Integration Details

Christine Giardino provided the integration details. (Please see Appendix E.)

User Experience

Christine Giardino was the only educator to use the virtual labs during the 2017–18 academic year. She used three different chemistry virtual labs in a weekly format. The virtual tabs were used in a supplemental leaning capacity where the students were instructed to complete the virtual lab prior to completing the corresponding in-lab exercises. A number of students did report technical difficulties, which may have arisen because of the software or Windows version installed on their computers. Both desktop and laptop computers were impacted; however, the educator never had an issue with her own laptop. The technical issues were generally resolved with the trial of a different computer or computer lab. Some virtual labs would work but would not display the on-screen buttons/tabs appropriately.

The following is the feedback provided by Christine Giardino during our March 9, 2018, meeting and the May 11, 2018, webinar.

- Overall, the virtual labs are beneficial as supplemental learning tools. Christine used the virtual labs to “flip” the classroom and would consider use as out-of-class assignments for future. However, she firmly believes that the virtual labs do not sufficiently replace the lab exercises in her course.

- She felt that the virtual labs would be worthwhile to continue depending on the cost to the student or college.

Christine also provided a list of concerns:

- There was clear evidence that students retained the information after doing the simulation.
- Simulations do not involve measurements or data collection.
- Students do not have to make decisions, observations, or perform calculations.
- Students do not have to select appropriate equipment or chemicals.
- Multiple choice questions are the only form of assessment.
- Simulations seemed to lag and not all of the buttons were accessible on certain computers.
- Students achieved higher marks on the simulations than on similar lab exercises. However, this is not necessarily because they understood the content better (they were doing the simulation first, followed by the lab, therefore the opposite would be expected).
- With respect to the positive survey results, I suspect that several students selected "agree" because of the simulations are easier than lab activities and lead to higher marks.

Value

A survey was administered to students in paper form after all the simulations had been completed. The completed surveys were then entered into SurveyMonkey for easier data analysis. There were only 17 survey participants (this is reflective of the significant program attrition secondary to the work stoppage). The results were generally positive and almost two-thirds revealed a willingness to pay for use of the simulations. Bob Chapman and Christine Giardino reviewed and discussed the survey results.

Please use the following hyperlink to view the survey results:

https://www.surveymonkey.com/results/SM–BTWZGW5RL/

Future Plans

This final report will be shared with the vice president of academics to determine the future use of Labster at Sault College. The college is planning to participate in an additional project that uses the Labster simulations in the biology courses in the PHS program. This represents an opportunity to gather data that we missed out on with this project.

The college is working diligently to expand online course delivery and virtual simulations, such as those from Labster, which are essential to this development.

Our academic team will review and discuss how to best use these simulations for future use and determine how best to fund them. Labster has a product capable of driving student demand and our goal is to have the simulations in place to meet the student demands on time instead of retrospectively. The sustainability piece is a priority.

Lessons Learned

Lessons Learned

- Labster offers a fantastic product and I expect their virtual simulations to improve as they expand. The type of simulation offered by Labster is essential to online delivery of courses with a laboratory or practical component.
- Planning is important and time is needed to review the simulations and trial them in advance of full integration. 1 recommend participation in a project such as this to begin that initial phase of integration in a cost-effective manner. In addition to the work stoppage, the time at which we started this project occurred after teaching plans were made and required simulation review and course integration during the semester. Ideally, the onset of a project such as this should begin in the primary planning period for the involved faculty (May and June at our college). This will likely provide more robust results in the level of assessment and integration.

University of Guelph

Project Description

In this project we used simulations in two second-year seminar-based molecular and cellular biology courses: MCB 2050 Molecular Biology of the Cell and MBG 2040 Foundations in Molecular Biology and Genetics. The initial project plan was to use the Labster virtual simulations in a seminar format, with TAs leading a group of approximately 50 students through one simulation presented in front of the class. We envisioned that at each opportunity—that is, each quiz question or "user decision"—the TAs would ask the students for responses. We believed that this would encourage collaboration among students, stimulate discussions, and increase seminar engagement. We felt that this could be in some ways superior to individual use, and it allowed all students in these two courses (1,000 to 1,200) to experience these simulations with a limited number of licences.

This project design was a unique approach that had the potential to provide original data about non-conventional uses of these simulations. This format could have served as an example providing the framework for large-scale implementation of these simulations with minimal associated costs. Because many undergraduate courses in Ontario have a similar seminar-based structure, this information would have been very valuable as eCampusOntario looks to make online tools such as these accessible throughout the province.

However, once we had access to the full suite of simulation, it became clear that this format would not work. Our seminar sessions are 50 minutes in length. The simulations that were appropriate for our courses, in terms of content, each had 45 to 60 quiz questions, and it would not have been possible to complete them within the seminar time frame. In addition, the audio function of many of these simulations was not functioning properly and we felt this would be difficult to overcome in the tutorial setting. Eventually Labster generously provided an additional 1,200 licences enabling all students to use the simulations individually.

While we did receive some positive feedback from the students, much of the data collected in this project was similar to that already collected by Labster and other similar projects. For these reasons we were disappointed with the final design of this project. By and large the implementation was a worthwhile endeavour but did not present any new or unique findings and, as such, is of limited benefit.

Team Description

The team for this project included the course coordinator (myself), the course instructors (two per course), and the chair of the MBG program curriculum committee. We communicated through regular curriculum meetings of which this virtual simulation project was a component. We communicated with learners through the course D2L websites, which is the main forum for information distribution in these courses. Links to the Labster website, access codes, and full account set-up instructions were posted on these sites. We also made multiple announcements about the project in lectures, and we were available via email for questions and support.

Integration Details

In MCB 2050 two simulations were integrated into the course, Crime Scene Investigation (CSI) and Medical Genetics.

Two of the 10 learning outcomes in this course focus on understanding molecular techniques and biotechnology and their applications in the field of molecular biology. Without a lab component in this course it has been difficult to meet these technique-based learning outcomes through traditional lectures and assignments alone. We chose the two simulations because the concepts and techniques covered closely aligned with our course curriculum. Specifically, the technique polymerase chain reaction (PCR) is covered in detail in this course and in several course assessments. Tutorial 2 is entirely focused on the concept of PCR and primer design and has traditionally been very challenging for the students. In an attempt to support student understanding of this technique we made the CSI simulation, which focuses almost entirely on PCR, available before students attended Tutorial 2. Two bonus marks were given to students for completing the simulation before attending the associated tutorial and completing the assignment.

In MBG 2040, three simulations, Meiosis, Mendelian Genetics, and Monogenic Disorders, were offered as review and mid-term study aids. For these simulations, student participation was poor with only 17%, 9%, and 9% of the students participating respectively. We believe this was likely because of the lack of marks associated with completion. In addition to poor participation, many students did not fully complete the simulations.

Many students complained of technical difficulties with simulations not loading properly or freezing. We also noticed many students from both courses did not complete the simulations, and we believe the technical issues were a major contributing factor. These issues were most likely experienced because students were not all using compatible devices, but it may be that the inconvenience of needing to use a desktop computer was a deterrent particularly when there were no marks associated with completion, as was the case with the MBG 2040 simulations. In addition, the average length

of completion appeared to have an impact on student attempts/completion, though this was not analyzed statistically.

From an educator perspective, the biggest challenge was finding simulations that fit well with our current curriculum. The CSI simulation was an excellent fit, but the other simulations were less so. Often only particular parts of the simulation matched course content or it was of a lower level than covered in these courses, resulting in limited value for reinforcing content. In some cases there was simply too much time devoted to one particular concept, and we felt that the time spent would not reflect how they would be assessed. It was for this reason that no marks were associated with the completion of the simulations other than the CSI lab.

User Experience

Student participation varied for each simulation. Typically, each student completed a lab only once, though often several attempts were made. Likely this was due to the technical difficulties experienced as mentioned above.

While it appears as though technical difficulties were experienced in both courses, we were only made aware of them from students in MCB 2050. We believe it was the mark incentive that encouraged students to ask for assistance in completing the simulations in this course. Once the problem was identified, a post was made on both course websites suggesting that students use desktops. This was effective for MCB 2050 but appeared to have little positive impact on student participation and completion for MBG 2040.

Overall, the training, orientation, and support for the virtual labs was excellent from the educator prospective. While any students experiencing technical difficulties were directed to the Labster support team, no students actually contacted them.

Value

We assessed the value of these simulations by attempting to analyze the impact of student participation on relevant student grades.

Results were separated by TAs. For seven of the eight TAs, the average Tutorial 2 grades were higher for students who completed the simulation before attending tutorial when compared to those who did not. However these results were not statistically significant (two-way ANOVA, p-value = 0.070). At any rate, because students self-selected for simulation participation it would not possible to establish clear causation.

In addition to analyzing student assessment grades, feedback surveys were emailed to students in the last week of classes. These surveys consisted of several questions regarding the tutorials in general, followed by three questions specifically about the Labster virtual simulations.

For MCB 2050, the feedback received on the CSI simulation was generally positive when asked if they found the simulation helpful in understanding PCR, a useful study aid, and if they would like to see more virtual simulations in their courses. For example, on a scale of 0 to 100, with 100 being the most positive response, the average response was 73 when asked if this simulation helped students in understanding the concepts of PCR.

For MBG 2040, the feedback was generally poor, with average responses of less than 55 (on a scale of 100) for similar questions. These results were not unexpected as we had received some negative feedback about the simulations used in MBG 2040 via email.

We believe the student feedback responses directly reflect how well the simulations matched course content, which explains the positive feedback for the CSI simulation and poor feedback for the others.

These results will be communicated with the Department of Molecular and Cellular Biology Undergraduate Curriculum Committee at our regular meetings.

Future Plans

We will continue to explore virtual tools as supplemental material for these courses and interactive and engaging activities for the seminars. As they stand, these simulations would not be suitable for continued use in these courses. Aside from the CSI simulation, the content covered was not closely matched with our learning objectives and did not fit with our time constraints. If educators had the ability to add and remove questions—perhaps even remove segments of the simulations—it would allow a tailored product that would be more beneficial to students. Not only would educators have more control over the length of the simulations but also over the content covered, there would also likely be more effective reinforcement of course concepts, which was the desired outcome for this project. More positive student feedback would also be more likely, as we have seen.

We are very cognizant of the time constraints students face and, therefore, tend to be reserved when assigning more activities and assessments unless they are of maximum value for time spent. Unfortunately, we did not feel that all of these simulations met these criteria. However, as Labster continues to develop these virtual labs we will revisit the simulations in our continued efforts to support our technique based learning objectives.

Lessons Learned

Lessons Learned

- As we have established, the alignment between supplemental material such as these virtual simulations and the course content it is meant to reinforce is essential for project success. Therefore, it is imperative that educators have full access to the product they are considering to use before committing to implementation. We found that while the demo lab safety simulation appeared to be an excellent product, most of the other simulations did not meet these expectations. We felt that we could not force students to participate, nor did we want to replace pre-existing course material without having full confidence that these simulations would be effective learning tools and a valuable use of students' time.

University of Ottawa

Project Description

For the fall semester of 2017, 680 students were registered in my course CHM1701/1711 (Principes de chimie). The original project foresaw using Labster in both a traditional course in the fall semester and a fully online course in the winter 2018 semester. In mid-October, it was not clear whether a fully online course would be ready by January (but it did get delivered with about 50 students, and again in the spring semester with over 100 students, and the students were required to purchase heavily discounted Labster licences). Therefore, we made use of this project's Labster licences in fall 2017, with 149 of our 150 licences attributed to volunteer students in CHM1701/1711. One licence was set aside for an undergraduate student employed by me to help out with the project. The 149 students were fairly representative of the entire student population of CHM1701/1711, skewing slightly toward high achievers. But overall, the group had roughly the same distribution of francophone Canadians, francophone internationals, and French immersion Canadians as the entire CHM1701/1711 class.

At the time of the application for this project, it was anticipated that only original English-language Labster experiments would be used. However, in a separate project funded by the University of Ottawa and in-kind contributions from Labster, all virtual simulations associated with this project were translated into French and made available to the 149 students. In fact, the students were free to choose between the original English simulation and the translated French versions. Roughly one-third chose English, and two-thirds French (it is university policy to have the right to submit evaluations in the language of your choice). Our partnership in the translation of the experiments allows us to offer Labster at a substantially reduced price, for both our fully online course and our traditional course.

Our traditional CHM1701/1711 course has five experiments in the "real" lab setting. The 149 student volunteers did three of these five experiments and four virtual simulations. Anecdotally, the feedback from the students on the virtual simulations (and the translations) was very positive. Labster also did a survey at the conclusion of the virtual simulations, and 94% of the feedback was positive. A more detailed survey was conducted independently by the university. One set of questions was sent to the 149 participants, and another survey was sent to the students who did not participate. The survey results indicated clearly that the project was a success.

Team Description

As professor of the course, and as vice-dean of the faculty, I took care of all of the logistics associated

with the project. The survey and analysis was conducted by Jovan Groen from the University of Ottawa's Teaching and Learning Support Service. As for the students, they were volunteers from all my CHM1701/1711 classes, which total 680. Though students can be from any faculty, they tend to come from Science, Engineering, and Health Science, and to a much lesser degree, Social Science (the B.Sc. Psychology program). Communication throughout was between me and my students as I handled the process of enlisting volunteers and fielding questions regarding Labster. Mr. Groen communicated with the students directly to conduct the survey.

Integration Details

As stated above, I incorporated four experiments from the Labster analytical chemistry and general chemistry libraries: Titrations, Acid-Base Reactions, Equilibrium, and Ionic and Covalent Bonds. Licences were issued to each of the volunteer students, who replaced two experiments in the traditional laboratory with these four simulations. This was done exclusively within a first-year general chemistry course where I was the sole instructor (other sections are taught in English, and they did not take part in this trial).

The virtual experiments allowed the students on several occasions to perform experiments that were not possible in a traditional setting. Many of the students commented that the accompanying videos and texts allowed them to better understand the theory behind the experiments they were carrying out. The multiple-choice questions left them little choice but to consult these pedagogical materials if they wished to get a high mark.

As an educator, I was pleased to see how students were repeating experiments until they got perfect scores, requiring them to master the material. Though virtual laboratories could seem to be a solitary activity, I was aware of some students having virtual "Labster parties" where they would go through the experiments together.

User Experience

It is clear that, overall, the students were extremely happy with the use of Labster. The numerical results within the survey they completed clearly indicate that the students felt they learned quite a bit from the virtual experiments. It should be noted that many commented that we should not entirely replace the traditional laboratory with simulations (this was not our intention at any time). So a hybrid approach of real and simulated experiments would seem to be the approach of choice for both educators and learners.

There was one technical issue with one of the simulations, and it was not clear if it was a result of our translation or an error in the programming. It has since been resolved by Labster.

There were no complaints from the students on our French translations of the Labster simulations.

All in all, the survey clearly indicated that the experiment of incorporating Labster within CHM1711 was a success. Independent of this program, we committed to incorporating Labster within our traditional fall 2018 and fall 2019 CHM1711 courses. It has been used in our online offerings of CHM1311 and CHM1711 in winter and spring 2018, and the same will be done in winter and spring 2019.

Value

We conducted a survey of those who took part in the Labster trial, and 75 of 149 learners responded. My department and faculty have been notified of the results, but I did not want to push for incorporation within the English sections of the course or within other courses in other departments until looking at results of surveys where students were required to pay for the licences. Given that the licences were free, students may not have had much invested in Labster. This year, with the students paying for the licences, we can assess whether students feel they are "getting their money's worth."

Overall, the survey indicated that students enjoyed the virtual laboratories. Of particular note:

- Students strongly agreed that they learned the concepts behind the experiments.
- Students felt strongly that they learned much about security and lab techniques through the simulations.
- Students reported that feedback provided throughout the simulations was good.
- Students felt they learned much more about theory with the virtual simulations, and there was a very slight preference for the virtual laboratories when it comes to learning safety and technique.
- Students reported that they would be very willing to retry a hybrid approach as we did in this trial or even a fully virtual laboratory. However, in the free format comments, many students indicated that a hybrid approach is far preferable and the traditional, or "real," laboratory should not be abandoned.

Future Plans

In winter 2018 and spring 2018, over 150 students (combined) took my fully online course, in both official languages, and the purchase of a discounted Labster licence was mandatory (a result of our collaboration on translating their virtual chemistry experiments). We will again offer fully online

courses in winter and spring 2019, and the use of Labster will again be mandatory, with the discount remaining in effect.

In the fall 2018 semester, in my traditional format of the CHM1701/1711 course, the use of Labster was optional and was being assigned a weight of 10%. The weight of the traditional lab was being reduced from 25% to 20% as we cut five experiments down to four (our fall 2017 trial had done a reduction of five to three), and 5% was reduced from the weight of the final exam. For those students opting out of Labster (at the time of writing, it was too early to know the percentage), the 10% goes to the weight of their final exam. The same will be done in fall 2019. The discounted licence agreement remains in place for at least up until the fall 2019 semester.

If possible, we would like to continue our translation partnership with Labster and maintain its use in my course. In each academic year, we expect this to approach nearly 1,000 students, distributed across my traditional fall course (French only) and my fully online winter and spring courses (both official languages). Very little support is required to maintain this arrangement.

Lessons Learned

Lessons Learned

Incorporating virtual simulations, in my case, was made a bit easier given my administrative role and seniority. I could foresee younger faculty members having trouble instituting such changes.

- First and foremost, the use of virtual simulations is only possible within an existing course by cutting back on other activities. In my original implementation, it replaced 40% of the "in-person" or "traditional" laboratory. Now, it replaces only 20%, and the weight of the theoretical component of my course had to make up the difference. Cutting back on the lab component, in any way, has consequences on TA duties for graduate students who require funding, and alternative solutions must be found. Given my administrative role, this is something I could overcome, but it is not easily done.
- Incorporating Labster was very easy. The support from the company itself was excellent, and the students overwhelmingly enjoyed the experience. Of course, this came with free licences, and the satisfaction level may not be the same if students feel that they did not get their money's worth.

University of Toronto

Project Description

The Human Biology in Action sandbox project closely builds on a previous research and innovation project at the University of Toronto (U of T), entitled Active Learning Opportunities through Virtual Lab Curricular Integration. Our original goal was to extend the availability of Labster resources across more courses and support an instructor-led research project to evaluate the student experience.

The project was successful in extending our capacity and building a community network of instructors interested in exploring this domain. A research project was successfully launched, and we were able to collect data across four courses. Data analysis is now complete and the instructors have prepared a journal paper based on this project.

We have continued interest and several projects and events planned for the coming months. The sandbox initiative has been successful as it has helped us to sustain our momentum in exploration of use of virtual reality in educational applications.

Team Description

This sandbox project extended work already underway at the university. Collaboration was undertaken by three U of T instructors at St. George campus and three staff members from Online Learning Strategies Portfolio who provided administrative coordination. A Labster specialist provided consultations for virtual lab content integration, logistics, and assessment components.

The project team included the project lead, Dr. Laurie Harrison, director, Online Learning Strategies, and three collaborating instructors:

- Dr. Dawn Kilkenny, assistant professor, Faculty of Applied Science and Engineering
- Dr. Maria Papaconstantinou, associate professor, Human Biology Program
- Dr. Ron Wilson, associate professor, Human Biology Program

This multi-expertise group has collaborated for over a year to identify relevant labs, design course curriculums, address IT integration aspects, implement Labster virtual labs in six undergraduate courses and one undergraduate summer research program, and evaluate the pilot phase of the project. With the eCampusOntario Sandbox licences, in addition to additional capacity available

through the previous research and innovation grant, we were able to accommodate 315 students over the course of the summer semester of 2017–18.

Online Learning Strategies (OLS) staff were in contact with the collaborating instructors and Labster specialists to follow up with their progress of IT integration and pedagogical planning and to identify and address potential issues. The following meetings were coordinated and organized by OLS staff, along with ongoing communication on project activities:

1. August 2017: Addressing technical integration of Labster virtual labs within Blackboard; sharing new course syllabuses.
2. October 2017: Sharing feedback and early lessons learned.
3. February 2018: Round table to discuss learning benefits of Labster virtual labs and potential next steps (summer 2019 and beyond).

Faculty development and capacity building for IT integration and curriculum design was ongoing and provided as needed. However, other than the initial setup of the Labster virtual lab links in Blackboard, the collaborating instructors required minimal support and assistance in implementing the labs. IT integration support was provided by an OLS staff member who was in contact with both the instructors and Labster support personnel.

The goal of curriculum design support was to ensure that Labster virtual labs as learning activities were explicitly contextualized within courses.

Integration Details

In conjunction with the sandbox project, instructors of two undergraduate courses and one undergraduate summer research program integrated Labster virtual labs in their curriculum as part of the Human Biology in Action Sandbox initiative. Here, we explain for each the course/program information, reasons for Labster virtual lab integration, Labster labs used, any changes in course grading scheme, and instructors' reflection on the perceived benefits of labs for their students' learning and any challenges that they may have faced. We used our ongoing communication with the instructors, their course syllabus, and the instructors responses to a Labster virtual lab integration survey.

Undergraduate Summer Research Program (USRP)
Offered through the Institute of Biomaterials and Biomedical Engineering (IBBME), Faculty of Applied Science and Engineering, the USRP accepts students from across undergraduate years and programs at U of T. In summer 2018, USRP was organized by Professor Dawn Kilkenny with 50 students enrolled. In this program, students could complete five out of 23 selected Labster labs and submit

an anonymous feedback survey to count as one lab skills workshop. Dr. Kilkenny provided a general description for each lab and indicated the techniques that each lab facilitated.

Selected Labster labs for USRP students were:

- Bacterial Isolation
- Cell Culture Basics-Transfection
- Mammalians Transient Protein Expression
- Cancer cell Preparation For Mass Spectrometry
- Biological Circuits
- Polymerase Chain Reaction
- Gene Expression
- Gene Regulation
- High-Performance Liquid Chromatography
- Microscopy
- Molecular Cloning
- Next Generation Sequencing
- Protein Synthesis
- Synthetic Biology
- Viral Gene Therapy
- Pluripotent Stem Cell Culture
- Cell Culture Basics
- FACS
- ChIP-exo
- ELISA
- Tissue Engineering
- Signal Transduction
- Confocal Microscopy

According to Professor Kilkenny, two main objectives of integrating Labster labs in the USRP were (1) to provide lab work opportunity in courses with no existing labs, and (2) to provide an opportunity to work on a lab that did not currently exist. Completion of the labs were participation based and students could voluntarily opt to complete five labs and an exit survey to count as one lab skills workshop. The overall advantages of this integration effort for students in USRP were to have extended and unlimited access to lab material and processes that the program could not provide otherwise; an opportunity for students to use Labster labs to deepen their learning; and, for those working off-campus, increased and facilitated access to labs without the need to commute to campus to participate in single lab.

Having completed the first offering of USRP with integrated virtual labs, Professor Kilkenny reflected that she would consider requiring all students to complete the labs so that the instructional team can gain a better understanding of the impact of different mode of lab work on students' learning.

HMB302: Vertebrate Histology and Histopathology

This third-year course is offered by Professor Ron Wilson at the Department of Human Biology, Faculty of Arts and Science. In summer 2018, 65 students registered in HMB302 and used the following Labster labs:

- Cell Culture Basics
- Confocal Microscopy
- Microscopy
- Mitosis
- Smooth Muscle
- Tissue Engineering

Professor Wilson was not available to answer the survey.

HMB265H, General and Human Genetics

Professor Maria Papaconstantino taught 200 students in this second-year course at the Department of Human Biology, Faculty of Arts and Science. In this course, two Labster labs were integrated:

- Animal genetics
- Cytogenetic

According to the course syllabus, completion of the two labs counted toward 5% of the final grade. To receive a completion grade, students needed to achieve a minimum mark of 50% in each lab before the deadline. The course syllabus also included technical information, general guidelines, and troubleshooting strategies while conducting Labster virtual labs. Students were advised to contact Labster in case their problems persisted. The syllabus suggested a template for such email communications so that students specify their course name, indicate the name of the lab, describe the problem, and add a screenshot of the error message.

Reasons for integrating Labster labs in HMB265, as Professor Papaconstantino indicated in the survey, were to increase students' motivation, depth of understanding in the topic, and access to resources; to extend current teaching; and to provide lab work opportunity in seminar courses with no existing labs.

Labster virtual labs contain theory pages that explain the concepts used in the experiments. These theory pages further strengthen the link between theory and practice as students progress through labs. Another advantage of Labster labs for HMB265 students was extended access to the labs to deepen learning in a self-paced manner. Finally, Labster labs provided a new learning resource for students that did not exist before this integration. Informal feedback from students showed they valued how Labster labs combined theory with practice and suggested that the labs increased their

knowledge of laboratory techniques. One success factor in lab integration, Professor Papaconstantino noted, was that labs were introduced early in the course.

Professor Papaconstantino proposed that for future offerings of this course, she would include Labster-specific questions in mid-term and final exam.

User Experience

As licence capacity from a previous grant was leveraged, a total of three instructors and 315 students used Labster virtual labs in two courses and one summer research program. Students had unlimited access to the labs that were selected for their course while the courses and the research program were in session.

TA support and training was part of usual training time and no additional time was required. Student support was not required either. Students did not require extra support to use Labster virtual labs.

The instructors did not report any technical issues during the fall 2017 integration process. Likewise, students did not face any technical problems while using the labs. In summer 2018, OLS staff successfully addressed licence expiry before then end of a program.

Value

A program evaluation and a research study were carried out to document the virtual lab integration process and to explore the impact of the labs on students' learning experience. OLS staff led an evaluation project that was approved as program evaluation, quality assurance, or quality improvement project and, thus, was exempt from research ethics review. The outcomes of the evaluation project are high-level insights regarding opportunities for use of virtual labs at U of T, which are available at http://www.ocw.utoronto.ca/virtual-lab-integration/final-report/.

A research project was conducted by the collaborating instructors with Professor Papaconstantino as the principal investigator. To conduct the research study, the instructors applied for ethics approval. The goal of the study was to examine the effectiveness of online virtual labs in improving student learning and student satisfaction in participating undergraduate courses. Study participants were undergraduate students. Participation in this study was strictly voluntary. An email was sent to all the students enrolled in the courses through Blackboard and invited them to participate in the study. Also, the instructors invited the students to participate in the study in class. Data was collected through a survey with 10 multiple-choice questions and one open-ended question. Each instructor collected the survey responses in their own course either electronically or on paper. Comprehensive data analysis is underway for collected data. Here we provide a summary of findings from two fall 2017

courses. Also, the instructor of the USRP shared anonymous results of a Labster student experience survey that she distributed in the program.

The answers to the open-response question in the fall 2017 survey provided insight into benefits of Labster virtual lab integration as well as areas of improvement as perceived by the students. Here we have distilled these comments, as developed through the research project, into broad categories.

Benefits of Labster virtual labs integration:

- Effective and thorough review of course concepts and theories, specifically complex concepts.
- Interesting for demonstrating lab techniques and skills in detail.
- Good learning resource (especially if it is available free of charge).
- Helpful, accurate, and realistic animations and visualizations.
- Useful for learning lab applications when there is no actual lab.
- Provides better visualization than an actual lab.
- Less expensive than physical labs.
- Good additional resource.

Areas of improvement and potential drawbacks:

- Simulations won't replace a real lab; not ideal for developing lab techniques and skills for real labs.
- Bugs need to be fixed; unexpected delays.
- Sometimes tedious and non-engaging.
- Navigation needs improvement.
- Sometimes lab safety was not observed.
- Lacks the option to pick up where one has left off (students could not save their progress and had to start over if they did not complete a lab in one session).

One of the instructors of the summer courses provided anonymous comments from the students who had completed the Labster labs, which we summarize here:

- Theory pages were helpful.
- Virtual labs were somewhat helpful.
- Virtual labs could help prepare students for hands-on labs.
- Virtual labs were easy to use.
- Self-paced and unlimited access to labs was helpful to students learning.
- Embedded quizzes and visualizations were helpful for learning.

Students would mostly choose to use the labs again, but students who provided feedback in this course, however, did not believe that Labster labs can completely replace hands-on labs.

In terms of dissemination, the collaborating instructors and the OLS staff members have already

shared interim insights from this work and will present and publish the findings of this study in academic venues such as at the University of Toronto Teaching and Learning Symposium, at the University of Toronto AR–VR Community Showcase, and in a peer reviewed journal.

Future Plans

Cost: A major concern about sustainability of Labster virtual lab curriculum integration was the cost associated with the labs. Students were in favour of free access to the Labster virtual labs used in these selected courses in the 2017–18 academic year. In future, the instructors are interested in using selected Labster virtual labs that they need for their courses, instead of the current model wherein all Labs in the catalogue need to be purchased as a whole collection. Labster has introduced a new pricing model to accommodate this possibility.

Support: Available support and instructor time were not prohibiting factors in integrating Labster virtual labs into the courses. The seamless single-sign on integration with our learning management system (LMS) was noted as a critical success factor. As we are changing to a new LMS, we require a new cycle of IT staff system integration/testing with the Labster platform, which will occur in the fall 2019 term.

Future projects: We worked with Labster to use fully immersive Labster VR labs, accessed through Google Daydream headsets, for a graduate Molecular Genetics courses. The course instructor and the OLS team collaborated on curriculum design for lab integration, preparing a research proposal, and creating a protocol for students' access to headsets. This course is underway and the instructors are planning to write a journal paper to share their findings. We are also working with two other universities in Ontario to explore a possible joint research and evaluation program to continue our exploration of use of web-based labs in undergraduate programs.

Lessons Learned

Lessons Learned

- With their first Labster virtual labs curriculum integration completed, the instructors reflected on how these labs can enhance students learning in a more effective way. One instructor explained that in future, she would make the completion of Labster labs mandatory, instead of voluntary and participation based, so that the instructor better understands how the differences in students

outcome in physical and virtual labs.

- At this time, Labster virtual labs are non-customizable. The instructors expressed their interest in having more granular control over the labs so that they can select the most relevant section of the virtual labs to complement and extend their instruction. Labster virtual labs also include quiz questions that accompany each lab. The instructors suggested these questions can be modifiable to connect more seamlessly with course content and learning goals. During the fall 2017 semester, students taking Labster integrated courses shared informal comments about their experience with Labster virtual labs with their instructors. A desired improvement to the labs was the ability to save their work, exit the lab, and resume it later. Currently, upon exiting a Labster virtual lab, students need to start over from the first step.

University of Windsor

Project Description

The primary aim of this project was to pilot virtual labs as an augmentation for physical labs as the Faculty of Science starts to develop more online programs where labs are still critical learning tools. The Labster labs were seen as a way to prepare students for on-campus labs, whether for online, hybrid, or on-campus courses.

The project is progressing slowly for a number of reasons, including implementation of new policies for educational technologies that apply a much more rigorous approach to evaluating privacy and risk abatement, and the implementation of our new enterprise resource planning (ERP) technologies, which have consumed all IT and many human resources, and placed significant limits on implementation of any new tools.

Despite the challenges, there is considerable interest from Forensic Sciences in using several of the labs as a regular part of their curriculum, starting with two courses that do not have textbooks (both courses rely on instructor-created resources at no cost to the students). The Department of Chemistry and Biochemistry is also interested in including Labster virtual labs in their new online courses. The first of these courses was planned to run in the winter 2019 term.

One microbiology course (primarily for nurses) and one forensics course successfully trialled Labster. Both made the lab usage non-compulsory, but the microbiology course assigned bonus marks for completion and also for completing a survey on their experience. The forensics course was not able to use the tool from the start of term, so it had less usage.

One of the challenges we encountered was integration with our learning management system (LMS) because of ongoing instability with the UWindsor systems, limited technical resources available due to the ERP implementation, and a new policy and procedure for making changes to the LMS that has just been implemented. Issues with instability were mostly resolved with an update, and Labster offered to host access through their own LMS to avoid any issues during the pilot (which is still the case for any ongoing usage). Labster had to be submitted to the new privacy impact and risk assessment process that is being implemented, and this is ongoing.

Students in the microbiology course provided qualitative feedback on their experience, while those in the forensics course did not. Both instructors indicated they saw value in the labs, and the forensics instructor plans to use them in at least two courses on an ongoing basis, with students paying for the cost of access. Both indicated a strong preference for students not having to pay, but the unbundling of labs and cost per lab that Labster offered was considered acceptable.

Team Description

The team consisted of the director of the Office of Open Learning, dean of Science, and individual faculty members who agreed to pilot the labs in their courses, plus the Labster team.

Labster was demonstrated to the provost, AVPA, and dean of Science with a visit to campus from the Labster team. An open workshop was held following that, and faculty who attended were invited to be involved in the pilot. A second workshop was also held and advertised to the campus through channels such as the Daily News (daily email newsletter to all of campus), communication through target departments and faculties, and communication directly to potential faculty.

In selected courses, Labster provided template information on how to access and use Labster, which was disseminated to students through the LMS. Student/instructor/course information was manually provided to Labster, and a Google Doc was used to track the project with Labster's team.

Integration Details

Two faculty were chosen to pilot the labs. Both chose not to make the labs mandatory, but the microbiology instructor offered bonus marks for completing the labs and a survey on their experience. No incentives were provided in the forensics course. Both instructors promoted the labs to their learners as supplemental materials that would help them learn the practical concepts.

Microbiology: The microbiology course had approximately 120 learners. This course typically does not have a lab in the online section (on-campus sections do, so this tool helps to make the courses more equitable and equivalent in learning), so the labs provided learning that would not have otherwise have been available to the students. The instructor selected five labs for students to engage with, and they were told to complete a minimum of two, plus the qualitative survey, in order to receive bonus marks. Some students who were familiar with physical labs from other courses indicated that they were impressed by how well the labs replicated a typical lab environment, and they saw value in them for that reason. The instructor in the course also indicated that she saw value, but was concerned about cost to students because she uses a commercial textbook and did not want to add any costs for students. There is an existing open text that may be suitable for the course, which may make it more viable beyond the pilot. At least one student recognized that there is an open textbook in the area that might be a substitute, and would be happy to pay for the labs if the textbook was open access.

Forensics: The forensics course is a fully online course as well, which does not typically have labs in the online section, so the labs were considered supplementary. Access to the labs was not available from the start, so much lower usage was seen, and no reliable data was collected from students. The instructor, however, saw considerable value in these labs, and hopes to continue using them in

other courses. He has experimented with most of the labs currently available in Labster and selected a series of them to apply to his courses. As with the microbiology instructor, there were serious concerns about cost, but the forensics courses typically do not have textbook costs as the instructors use their own created resources, so the cost of individual labs was seen as not being too prohibitive to proceed.

Students and instructors reported a simple sign-up and access process (even though Labster was not integrated to the LMS), and few technical issues overall. Students generally only accessed the desktop version of the tool, but reported that they enjoyed using it, and most indicated they would be happy to use it, with the caveat that it should contribute to the overall grade in the course.

User Experience

We do not have data on how often the labs were used, but the microbiology students indicated they used it fairly often.

The microbiology instructor selected five labs for students to access, while the forensics instructor selected two. Students described the labs as fun, challenging, authentic, intuitive, fluid, and easy to comprehend. Some said the labs helped them to understand the theoretical concepts, as well as introducing them to the practicalities. Others talked about how they reinforced their understanding.

Students commented that the labs were at about the right level for introductory microbiology, and took a reasonable amount of time to complete.

Some students (and the instructor) reported lagging and slowness at times. Most were accessing labs over wireless connections and, as they were using their own devices, may have had older or lower-level equipment. A small number of the students said they would not pay for the simulations for a range of reasons (most often because they didn't think they would be crucial to the course), or would only pay for them if they contributed to their grades.

No issues were found to be blockers to the use of Labster. The challenges that did exist were usually related to the university's own IT capacity, or internal policies and procedures. For example, a new privacy impact and risk assessment approach for new technologies (and especially those that interface with other systems on campus such as the LMS through LTI) was implemented during the pilot and Labster is still going through that process. This is a necessary and important step, but it does take considerable time, and because the process is in beta, it is not always clear. One flag that has arisen in that process is that Labster's standard terms and conditions allow them to collect data from student activity for their own purposes, but students by default have no way to opt out of that (student data is by default able to be used for the above purposes), and it is difficult to determine how to either opt out or remove data. This issue is not resolved yet to allow for full integration. However, if students do choose to read the terms and conditions, they will find them relatively unambiguous

and clear on what Labster intends to do with the data, including limits. The university is looking at whether there is a way to facilitate positively affirmed consent, or to remove the ability to use student data by default.

Throughout our engagement, the Labster team have provided good communication, engagement, flexibility, and support.

Value

The microbiology course used an online survey (administered by the faculty member) that included open-ended questions that asked about:

- Ease of use of the simulation/software.
- Level of difficulty/content.
- How useful/relevant the simulation would be as a resource for Introductory Microbiology.
- How interesting/engaging students found it.
- How students felt about the idea of paying for access to this type of software.

Student responses were anonymous. Responses were collated and themes were derived from the data.

The forensics instructor chose not to formally evaluate the student response due to the limited nature of the usage in his course.

Future Plans

Labster was found to be sustainable and useful as a tool, using the student-pay model. Further piloting is planned over the coming year following a full privacy impact and risk assessment evaluation. This will allow it to be integrated to the LMS once technical capacity is restored to the LMS team. Some customization of the connection between the LMS and Labster may be needed to allow students to opt out of their data being used for Labster's own research. We are currently investigating the feasibility of this.

Faculty will continue to be offered pedagogical support for intentionally integrating virtual labs and simulations into their courses. We also look forward to the release of the lab builder tool to allow for customization of the simulations.

Lessons Learned

Lessons Learned

A number of lessons learned may be helpful for others.

- Explore unbundling to allow instructors to choose the individual labs that make sense to their course and their students. Determine the point at which it will become cheaper to buy access to the full catalogue.
- It is very important to thoroughly vet the contract that will cover the use of the tool. Particularly, the use of student data while in the system, data passed from the LMS if integrated, and any opt-in/opt-out capabilities that may exist.
- Students will have variable access to the labs depending on their computing equipment, Internet speed, and so on. Ensure there are alternatives on campus available for people who can't access the labs from home or elsewhere, and consider what the alternative may be if students are unable to complete the work for other reasons (e.g., medical reasons).
- Think of the simulations as an augmentation to physical labs, not a replacement for them.
- Students are more likely to complete the labs if they receive recognition for that work, usually in the form of a contribution to their grades.

York University

Project Description

Labster virtual labs were incorporated into BIOL1500, a face-to-face introductory biology bridging course that serves as a "12U" (senior high school course) replacement. Students completed the virtual simulations on their own outside of class time. They then used the knowledge and experienced gained in the simulations to complete in-class activities. The simulations and associated in-class activities helped students reach core course learning objectives.

Originally the goal for this project was to use Labster virtual simulations as a complement to in-class content. Virtual simulations would allow for the visualization and review of difficult concepts and further enable self-directed learning. As BIOL1500 does not include a wet-lab component, Labster would also allow students to experience the process of scientific investigation in a hands-on fashion, adding an experiential element to the course structure.

We believe these goals have been reached and the project has been successful. Students expressed satisfaction with the virtual simulations; many of them self-reported revisiting the simulations to study for tests and better understand material. After completing the simulations students came to class asking more probative questions, having deeper conversations with peers, and being more engaged with the related in-class material.

Students said that simulations were "fun" and "cool" several times, and there were no complaints about the simulations themselves. There were a few technical issues, which are addressed below, but overall students enjoyed the experience.

One additional goal of the project was that the use of virtual simulations allowed students to gain core lab competencies that would help them succeed in future life science coursework and professional opportunities. Students have not yet moved on to future life science coursework or professional opportunities, so it remains to be seen if this goal was reached. However, the simulations prompted several discussions about "real" labs in class and career options in biology. These discussions suggest students were treating the simulations as "real" lab experiences.

The vision and goals of the project did not change over the process. However, major structural changes to the course were required due to the labour disruption at York. BIOL1500 was suspended throughout the strike (starting March 5, week 7 of 12). The course resumed at the start of the remediation period (July 22), but was completed in a very individualized fashion and no longer face-to-face. This disruption and the necessitated course changes make outcome comparisons to previous course offerings without virtual simulations difficult (post-week 7). The disruption also changed the

plans for project analysis. That being said, students visited the virtual labs during the strike and used them to stay connected to course material even while the class was suspended.

Team Description

There were numerous discussions with, and support from, the executive/management team of the Biology department (undergraduate program director, chair), Faculty of Science (associate dean, students) and York University (associate vice president, Teaching and Learning) as well as the Scholarship of Teaching and Learning team at York's Teaching Commons.

The closest and most frequent communication was with Alex Mills (associate dean, Students, Faculty of Science). Discussions were often held on the project goals and status, and he assisted in updating other stakeholders, mainly the AVP Teaching and Learning. The staff at the Teaching Commons reviewed the course plan and the research ethics application before the start of the semester, providing expert guidance and feedback. Discussions with the chair and undergraduate program director of the Biology Department also happened at several points throughout the year.

We also worked with the Labster implementation team to ensure smooth integration of the virtual simulations into the course structure and to keep them updated of any issues arising. Representatives of Labster and eCampusOntario were contacted during the labour disruption to alert them to the changing needs of the course, and they were able to assure Labster licence extensions to support students throughout the course remediation process.

We created material to help learners connect virtual simulations to course learning goals, and integrated Labster with in-class experiences. Students were provided with multiple online and in-person means through which they could ask questions and learn more about the virtual simulations project.

Integration Details

BIOL1500 started with an enrolment of 120 students (January 8; 100 as of July 22). Virtual labs were integrated into the course and were a component of the final grade. Therefore, all students should have registered and used the virtual simulations (I discuss usage rates below).

Students were assigned five mandatory virtual simulations with an additional four optional simulations. For the mandatory virtual simulations, participation marks were assigned for finishing the simulation by a certain date. For four of the five mandatory simulations there were also associated in-class activities where students worked in groups to learn more about the topic and their learning

was assessed. Of those four in-class activities, three were completed before the strike (March 5). The labs were aligned to key learning outcomes of the course, and completing the simulations along with the in-class activities helped prepare students for tests and exams.

Students were provided with a virtual labs assignment outline and individual instructions for each lab at the start of the term. While students had to complete labs by a certain due date to receive participation marks, they could complete the labs at any time. The instructions for each lab briefly describe the lab content, connected the simulation to the course learning objectives, and provided a completion checklist. The checklist helped situate the simulation into the course by providing textbook and other readings to help familiarize students with background material that would help them understand the lab, described the in-class activity, and connected the simulation with what we would be learning in the future.

Only one educator used these virtual simulations at York University. That educator was teaching five other courses concurrent with BIOL1500 and had a secondary position supervising student leadership programs at one of York's colleges. Support was available at the departmental, faculty, and institutional levels, but all decisions about course structure and addressing day-to-day learner needs was the educator's sole responsibility. Given this, the excellent support provided by Labster and the ease of use of the virtual simulations were strong benefits to the project.

The speed at which Labster responded to issues and the number of times they checked in to ensure things were running smoothly was impressive. The labs were also user friendly. There were very few usage questions from students; they seemed able to navigate the system and work out any issues on their own.

There can be conflict between what improves student learning outcomes (mainly active learning) and how students believe they learn best (lecture). Some students feel they are being forced to "learn on their own" if they are not lectured on a topic. There were no complaints about Labster. Students seemed to genuinely enjoy the experience. Witnessing the animated discussions and debates as they worked through material in the associated in-class activities was very rewarding. It was clear students were engaged and were thinking deeply about the subjects.

The main challenge was the cost of the simulations and the technology requirements. There are on-campus computer labs that are capable of running the simulations, and information on these labs was provided to students. However, we are a commuter school where many of our students work and/or have family obligations outside of class. This makes computer lab use less convenient, and it is possible that participation in the labs would decrease if students don't have the computers necessary to run the simulations at home. That being said, only one student mentioned this concern, so other than needing to be prepared with on-campus solutions, it was not a large challenge. The cost of the simulations could be a future challenge, but one of the biggest benefits of this project was being able to provide licences to students for free in this pilot offering. It allowed for focus on integration and other issues, ensuring there was a benefit to the simulations, before burdening students with the cost.

User Experience

Simulation completion dates were tied to when the associated learning objectives would be covered in class. Most of the virtual simulations corresponded to earlier course material, and the first four mandatory labs were completed between January 11 and February 6. Labs were scheduled so that there was never more than one to be completed in a week. The schedule of labs and due dates was prominently posted on the course website and all dates were listed in the assignment outlines. Students still had many questions about scheduling and timing at the start of the semester. These questions decreased after the first lab was completed, and for the most part students were able to follow the due dates without issue.

There were 118 students enrolled in Labster (i.e., registered their licence; class size approximately 120). The number of students who completed the virtual simulations in the pre-strike mandatory labs ranged from 86 to 110, a good participation level. In comparison, of the 120 students enroled at the time, only 105 wrote the in-class mid-term. Three of the four labs saw completion rates of 93 to110 students. The mandatory lab that the least number of students completed (86) was the simulation not associated with an in-class activity.

The lower completion rate of the mandatory lab not followed by an in-class activity (86 students) and the extremely low participation in non-mandatory labs (where subjects were covered before the strike; four to 11 students) suggests that integration of virtual simulations into in-class components, and into grading scheme, is necessary for good student buy-in.

Interestingly one of the mandatory labs (Evolution) had a due date for completion of March 22. The labour disruption started on March 5 and when classes resumed (July 22) the lab was made optional. Students could complete the simulation if they wished and have it count toward their grade, but if they did not complete it they would not be penalized. Nineteen students completed the simulation after the start of the strike. This suggests, at least for some students, the virtual simulations were key self-study tools.

Labster provided excellent support and the virtual simulations were very user friendly. Labster provided handouts for students on how to register for their site, technical requirements, and support options. These handouts were very useful and helped address many student questions and concerns.

While students were provided with information for the Labster support, we also set up a “trouble” form on Moodle (our course LMS) that could be submitted anonymously, and encouraged students to send an email if their issues could not be resolved by Labster. Students felt no need to report issues anonymously, and the handful of technical issues that occurred were either signed (on Moodle form) or through email. These issues were small in number and minor. Most were about inability to access their account, which was mostly a user error that was quickly addressed once the concern was forwarded to Labster.

Value

Data gathering and analysis were the aspects of this project most heavily affected by the labour disruption and suspension of BIOL1500. We intend share experiences with all stakeholders including at departmental, faculty, and institutional meetings.

The virtual simulations were incorporated into the course structure so that much of the data needed would be generated as part of mandatory coursework. In addition to this coursework data, a student survey was designed to address learner experience, which was to be delivered to students after final grades had been submitted.

York's Senate policy on research involving human participants guided the assessment planning, and work was done with York's Teaching Commons to finalize assessment design and submit a proposal to the research ethics board. The Teaching Commons advised that delivering informed consent documents was best left to closer to the end of term as the only data not part of mandatory coursework (the experience survey) would not be delivered until after the course ended. Unfortunately at the start of the labour disruption (March 5), we were still awaiting final ethics approval, and informed consent was never received from any student.

Despite the issues mentioned above, an evaluative approach to assessment can be taken using the coursework-generated data that respects the rights and confidentiality of students. However, the strike still necessitates some changes and has led to a delay in when coursework data will be available.

Students seemed to thoroughly enjoy using the labs. After completing a virtual lab many of the discussions and questions from students about associated content were at a deeper level than usual. We believe it was a positive learning experience for my students.

The original goal was to design pre- and post-simulation assessments to measure student learning gains after using Labster. Questions were used from a standardized diagnostic for introductory biology as part of a learning activity during the first class, which provided a pre-simulation assessment of learner knowledge (Shi J, et al., 2010). The plan was to incorporate the same questions into the final exam allowing for pre- and post-simulation assessment. While this assessment would capture all learning in the course, not just simulations, it would provide a standardized way to track learning gains if carried across years (e.g., if in future offerings the type and number of labs change). The diagnostic questions used were also specific to the learning objectives covered by the simulation. Unfortunately this planned assessment is no longer possible as post-strike remediation necessitated changing the final exam format to a take-home written test; also, students no longer have to complete the final exam.

Student responses to, and grades on, the lab associated in-class activities can also be used to assess student learning gains from the use of the virtual simulations. Three of the four planned activities were completed before the strike.

The course structure originally included two mid-terms and a cumulative final exam. The plan was to add bonus questions to each test that covered information the students would have encountered in the labs. The questions would be related to a course learning objective but a bit beyond the level we'd cover the material in class. The intent was to assess retention of information from the simulations themselves instead of other class material. Only the first midterm was held before the strike, and on that test there were three of these bonus questions. Between 54% and 68% of students correctly answered the questions (depending on the question), and only 10% of students answered all questions wrong. This suggests students were learning and retaining information from completing the simulation alone.

Many of my final exam questions were designed to serve an evaluative purpose. They were mapped to learning objectives, and correlated well with student learning. If students had completed the original final exam during this project comparing their performance on these key questions with previous, non-simulation semesters, it could have provided interesting information. This may be possible if virtual simulations are used in the future.

Future Plans

The use of virtual simulations in BIOL1500 was a success. The use of virtual labs helped students to more actively engage in course material and reach the course learning objectives. Despite the disruption and course changes that make a full analysis of project results difficult, it would be helpful to use Labster or other virtual lab simulations again.

It was always the intention to continue integrating virtual simulations into BIOL1500 if this project was successful. The experiences were positive enough very early on in the semester to decide that integration should continue into the 2018–19 school year. Unfortunately, with the changes necessitated by the labour disruption, the continued integration of Labster for the fall 2018 was not possible.

One major concern for quality and sustainability is the cost of student licences for Labster. York has an ancillary material policy that caps online tools used for student assessment at $60 (like textbook associated quiz platforms). While the ancillary policy may not apply to virtual lab simulations, the spirit of the policy—keeping courses financially accessible—should be honoured.

A handful of students were able to discover the approximate $80 licence fee for Labster either by exploring the site on their own or actively searching for the information. They reported that they were glad to have free access since they would not have been able to afford the licence. This further affirms that the cost of Labster access would be a hindrance to future use.

It was the instructor's practice to always waive participation for those who could not afford it when ancillary material was used in a course (usually textbook-associated quizzing platforms). If necessary,

alternative assessments were offered. The integration of Labster into BIOL1500, which worked quite well, involved in-class activities completed in groups. These activities allowed students to reinforce the concepts they were learning in the simulations, and to use the labs to build group work skills which enhanced in-class discussions and other active learning experiences. If costs prevented some students from accessing Labster, the quality of the learning experience for all could diminish.

One way to mitigate the cost aspect is to switch BIOL1500 to an open textbook. Currently the mandatory course textbook is approximately $120. While some students buy a used textbook or the e-text (approximately $100) most students buy a new textbook. If instead the textbook were fully open and free, the incorporation of Labster would not be as large of a burden to students. There are many sources of open textbooks for introductory biology, but they would have to be evaluated to find the right fit. This will not completely solve the cost issue; some students will still be unable to afford Labster. With the support at the departmental and faculty levels to help come up with additional solutions, and if an appropriate open textbook can be found, future use of Labster in BIOL1500 is likely. There may also be lower-cost alternatives to Labster that could be used in a similar manner. That being said, given the positive experiences during this project, we would be reluctant to go this route.

We had discussions with Alex Mills (associate dean, Students, Faculty of Science) about using the Labster virtual simulations as the starting point for flipping and blending BIOL1500 extensively. The way Labster was integrated for this project lends itself easily to a flipped and blended structure where students would complete labs on their own time, focusing class time on associated activities. Other course material would be covered in a similar fashion with online readings, lectures, or other components being completed before class and the students using class time for more active learning.

With the support of Alex Mills, the plan was for the instructor to spend the summer both analyzing this project and preparing BIOL1500 for the above-noted structural change including the continued incorporation of Labster virtual simulations. In fall 2018 the hope was to run the course as a flipped learner experience with Labster virtual simulations and using an open textbook. Then by winter 2019 BIOL1500 would be restructured into a blended course offering (defined as at least one-third of class offerings being replaced by online/other components). This was not possible because of the consequences of the strike.

We still believe the plan outlined above is possible, sustainable, and would improve the quality of the learner experience. It is therefore still the goal to incorporate Labster in future versions of BIOL1500.

Lessons Learned

Lessons Learned

- Quality support from the company providing the service is essential. With Labster handling technical support and being responsive to questions and needs, the instructor was able to spend more time focusing on course material, assessment, and student support. Integrating any new course component has its difficulties, and having access to good customer support can't be underestimated.
- This project was undertaken during a very busy time. It would be helpful to schedule a semester to plan and create material, which would likely result in a better experience.
- It would have helped to have more time, especially in the beginning of the semester, to stop and reflect on the progress and success of the virtual labs. Educators need to be mindful of their own time commitments and leave themselves some room to reflect on their experience and make adjustments as necessary. That being said, it is possible to integrate virtual simulations well even with severe time constraints.

References

Shi, W. B. Wood, J. M. Martin, N. A. Guild, Q. Vicens, & J. K. Knight. (2010.) A diagnostic assessment for introductory molecular and cell biology. *CBE-Life Sciences Education*, 2010, 9, 453–461.

Virtual Lab Simulations: Additional Resources

Curated Resources

Labster produces helpful documentation for its virtual simulations. The links below provide a sampling of these resources:

- Labster Best Practices
- Labster Blog: https://blog.labster.com
- Labster Instructor User Guide
- Labster Student User Guide for EdX
- List of Labster Simulations: https://www.labster.com/simulations
- University of Toronto Labster Experience: https://blog.labster.com/our-labster-experience-laurie-harrison-university-of-toronto

EXPERIENTIAL LEARNING: RIIPEN

Key Findings: Experiential Learning

Experiential Learning Overview

Experiential learning, as defined by Simon Fraser University, is "the strategic, active engagement of students in opportunities to learn through doing, and reflection on those activities, which empowers them to apply their theoretical knowledge to practical endeavours in a multitude of settings inside and outside of the classroom."[1]

Experiential and work-integrated learning is aimed at enriching the student learning experience and is a fast-growing pedagogical strategy being adopted by Ontario post-secondary institutions. In a 2013 report, it was estimated that over half of Ontario post-secondary students will graduate after moving through an experiential or work-integrated learning component at some point during their studies (Satler and Peters, 2013).

Most Ontario post-secondary institutions have experiential or work-integrated learning supports in place that provide students with opportunities. However, with this growing demand across disciplinary contexts, a third-party experiential learning platform such as Riipen can be leveraged to both scale and streamline the process.

The Riipen platform helps by setting up the assignments, coordinating the matching process, and overseeing them through to completion. Riipen provides an online space for educators to create experiential learning projects, match those projects to an organization, and then match the learners to the project. Throughout the process, the learner receives feedback from the organization as well as from the educator, and, upon completion, is assessed for performance.

The eCampusOntario Educational Technologies Sandbox case studies involved experiential-learning explorations in a range of courses in three institutions: Fanshawe College, La Cité collégiale, and University of Windsor.

Experiential Learning Integration

Fanshawe College applied the Riipen platform in the capstone course of the Bachelor of Commerce program, with competencies aligned to an experiential learning assignment on market assessment

1. Retrieved from: https://www.mcgill.ca/eln

analysis for a company partner. Fanshawe also incorporated experiential learning assignments into two of their technical programs: Heating, Refrigeration and Air Conditioning Technician, and Gas Technician program . These customer service skills-based projects aimed at building communication methods, troubleshooting techniques, and hands-on repair skills.

La Cité collégiale applied a two-pronged plan for applying experiential learning. The first was the more traditional format of matching students to projects and employers. The second was to seed the platform with areas of research with the hope of attracting employers to these projects. La Cité kicked off the Riipen pilot by offering training and orientation to both experiential learning and the Riipen platform to educators at their institution. This was considered a good first step, as it proved helpful not only to onboard educators to experiential learning as a teaching and learning approach, but also to spark their interest in ideas for project formation.

The University of Windsor envisioned their integration as a chance to include micro-experiences in courses within their Faculty of Science. These opportunities were focused on building learning partnerships with wineries, breweries, and greenhouses—all of which are experiencing growth in the Windsor region. Industry engagement events were held to get all the parties together to discuss opportunities for experiential learning.

Team Description

Team members across institutions included faculty, faculty administrators, program coordinators, staff from teaching and learning centres, employer partners, media production staff (for video production), research personnel, and students. Teams collaborated through meetings, orientations with Riipen's customer success team, and by completing and uploading projects.

Value

The Riipen pilot project proved to be a good exercise to evaluate the platform, despite several challenges: delays to full integration, the college faculty strike in fall 2017, the time needed for orientation to the platform, and complex considerations about who to partner with and how. Despite these issues, the educators who participated in the pilot saw the value in using the platform in their educational contexts (and in some cases, beyond). They reported that after having used Riipen in a small way, they could imagine how it could be integrated more broadly.

The impact of the faculty strike was particularly high because the experiential learning projects needed facilitation by faculty. Both our college partners indicated that the lost time planned for

implementation was redirected to onboarding to the platform and brainstorming on how it could be potentially used. These are valuable processes, but they did not directly assess Riipen as a tool.

La Cité experienced another barrier to integration specific to their institution: there were very few francophone projects available. Eight "traditional" format projects were added to the platform, but there were no francophone industry partners to provide a match. There were two applied research projects added, which received promising feedback from potential partners, but they did not get off the ground due to timing and resource issues.

At Fanshawe College, the customer service project was not successful because the students were reluctant to be filmed. In response, a workaround was proposed, making participation voluntary for students, which increased the uptake, particularly in the Gas Technician program. If there are to be future implementations that use video feedback, a filtering process would be used allowing students to approve the videos prior to sharing them with employers. The project leads reported that it is difficult to motivate students with an optional assignment.

The University of Windsor's Riipen project was also not successful, but not for reasons of disinterest or poor planning. Barriers included the lack of time for faculty to understand and effectively integrate experiential learning as an assessment into their courses, the concern about ongoing cost of the platform, and a sense that the Riipen platform was compromising work covered by Windsor's Experiential Learning Office.

Technology User Experience

- Fanshawe College indicated that it found the platform to be user-friendly and that Riipen provided excellent technical and client service support.
- La Cité reported ease of use and a good technical experience, but the English-only aspect of the platform was a definite detractor.
- Windsor was unable to integrate Riipen into their learning management system (LMS), and while they found the client service support valuable, their reality is that to map experiential learning activities to course learning outcomes would require significant support from teaching and learning staff.

Future Plans

- Fanshawe is considering college-wide adoption of an experiential learning process/platform and will engage with academic managers across campus as they work to determine licensing costs, support, and training options.

- La Cité is developing plans to address the francophone project gap by engaging with stakeholders to try to collectively propose solutions including platform translation and sourcing more francophone industry partners.
- The University of Windsor has elected to extend their Riipen licence to allow for further investigation. Since starting this evaluation, Windsor developed three courses entirely aimed at experiential learning, which was viewed as a good alternative to trying to inject experiential learning into existing curriculum. This initiative, in combination with faculty development workshops and industry partner communication, is the next step in considering if experiential learning with Riipen is effective and feasible.

References

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall.

Sattler, P., & Peters, J. (2013). Work-integrated learning in Ontario's post-secondary sector: The experience of Ontario graduates. Toronto: Higher Education Quality Council of Ontario.

Fanshawe College

Project Description

At Fanshawe College, we had two teams working on separate projects. Reports for each follow.

Candace Miller, program manager, Lawrence Kinlin School of Business

1. The primary goal of this project was to increase community and student engagement in post-secondary programs (Child and Youth Worker, Bachelor of Commerce–Management) through offering experiential learning opportunities with Riipen. The projects were put on hold during the academic strike in the fall of 2017 because the projects were facilitated by faculty. After the strike, the work with the Riipen platform commenced and client connections were made.
2. The experiential learning project was a requirement in the Bachelor of Commerce (Management) Capstone Client Project course (MGMT-7025). Students in the course worked toward completing the several competencies that align with this project:
    a. Formulate strategies to establish effective working relationship with clients, suppliers, and coworkers.
    b. Identify project tasks and establish strategies to complete the tasks, clarifying individual roles, responsibilities, and accountabilities for deliverables.
    c. Communicate marketing recommendations persuasively/accurately in oral, written, graphic formats.
    d. Develop an appropriate business strategy and tactical plan for marketing products, concepts, or services to an identified market.
    e. Design recommendations for optimization of digital technologies to improve business performance.
    f. Develop professional development strategies/plans to enhance leadership and communications expertise.
    g. Use appropriate information technologies to maintain accurate and timely information on all client, supplier and coworker interactions.
    h. Work as a collaborative team member to achieve project goals and objectives.
    i. Participate efficiently and effectively in meetings using professional protocols.
    j. Draw conclusions and propose courses of action based on second and primary market research information.
    k. Perform research, prepare assignments and presentations, and engage in communication and collaborative activities with peers, clients and other stakeholders.

3. Data from learners and employers was gathered using an electronic survey tool (before and after the project) in order to capture expectations and user satisfaction from the different perspectives.
4. The project was successful in that it gave us a good idea about how this platform works, we gathered more information from the vendor via a couple of meetings and conference calls. We may investigate this application to support a new project, along with similar applications. More discussions are needed over the fall semester to make this decision.

Lisa Wells, manager, Continuing Education and Contract Training, Woodstock/Oxford Regional Campus

The original project was to connect employers with our graduates of our Heating, Refrigeration and Air Conditioning (HRAC) program. At an advisory meeting for this program in early 2017, the employers indicated that new hires struggle with customer service and that we should enhance this component of our program. In response, we set out to create a customer service challenge for our students. Originally we felt that we needed to combine a customer service exchange with a technical task, so we decided to create a furnace service call. As an element of this culminating project, students were required to create a video during which they addressed a service issue. This video was to be uploaded to Riipen for an employer to view.

The project was not successful for a variety of reasons, but what we learned from this project was vast. Our first challenge was that we had a faculty strike in the middle of the academic year which shortened both terms. We also found out that students were not keen to be filmed, nor did they want to volunteer for a project. We had only one student volunteer to complete the task and they were unable to solve the technical problem so they did not want to use their video.

Since we were committed to this project we decided to try it with our Continuing Education students in our Gas Technician program. There, we had a slightly better result. We had six people volunteer, but in the end only four actually completed the video project. However, the video provided a lot of insight into what parts of a customer service scenario our students struggle with. We also decided that a filtering process was needed so that only the best videos would be reviewed by the employer.

Team Description

Mike Tucker, professor, Lawrence Kinlin School of Business

Faculty and project support team members participated in Riipen webinars and accessed the sandbox tools. In the Kinlin School of Business, the experiential learning project was facilitated in the Bachelor of Commerce (Management) Capstone Client Project Course (MGMT-7025), which has 12 students.

Mike Tucker was the professor of the course and worked daily with the students and the client to ensure good communication and collaboration.

Lisa Wells, manager, Continuing Education and Contract Training, Woodstock/Oxford Regional Campus

We had our program coordinator of our HRAC program, Greg Taylor; our employer partner, Mike Kapin from Mike's Heating and Cooling; our shop assistant, Ben Sharpe; and Norm Wronski, our videographer involved. We communicated in person, online, and on the phone. We asked the students to volunteer during class as well as online.

Experiential Learning Details

Mike Tucker: Twelve MGMT 7025 students were originally engaged with two clients, which was reduced to one after the five-week labour disruption in October and November. Students completed a market assessment analysis for a company, Deetag, in London, Ontario. Client projects for the MGMT 7025 Capstone were completed on January 18, 2018, and graded by the professor, as per the published rubrics in the course information sheet, with feedback and comments provided by the external client.

Lisa Wells: Our project had each participant perform a customer service/technical demonstration of a furnace service call. The participants engaged the customer to find out what the problem was and then had to repair the broken furnace. The students were evaluated on how well they interacted with the customer, whether they answered the customer questions, the steps they took to troubleshoot the furnace issue, and whether they could fix the furnace in the time allotted. In retrospect, this was a difficult challenge for the students for a couple of reasons. They felt a time pressure that wouldn't necessarily be there in the field. Two of the four participants said things that would give a homeowner cause for concern as they were just trying to make conversation. One of the four was not able to solve the problem.

Technology User Experience

Mike Tucker: The platform was used with one client. I worked with the client and the platform during the period of the course.

Lisa Wells: As mentioned above, we struggled to complete the project with participants. We had to start over with a completely different class. We waited for our employer to upload his profile so that our finished videos could be evaluated.

The support from Riipen has been excellent. They had to explain the project and what the steps were several times during this project. We couldn't ask for better support. We have been challenged by students not wanting to be part of the project.

We met with Riipen representatives in the late winter of 2018 and provided feedback at that time.

Value

Mike Tucker: Because there was only one client and small number of students I gathered feedback informally. I have and will share his experiences with professor colleagues and academic managers if further work with Riipen commences.

Lisa Wells: We found out that students were not keen to participate in this project. We would need to make this a mandatory component of their program in order to get more participation. Our demonstration had too many aspects to it and this made it hard to film. I would recommend trying this approach again in a different area. There were valuable teaching moments during this process as two of the individuals really struggled during their demonstrations and their instructor was able to give them good feedback to help them be successful on the job.

Future Plans

Mike Tucker: In future, Riipen could again be used to match eighth-term management and digital marketing students to organizations looking for projects that require the attention of a capstone learning experience.

Two other potential adoptions of the Riipen platform we are considering include:

- Using Riipen to recruit companies to participate in the Community Consultancy course, which is offered in four graduate certificate programs. This would potentially affect 60 students and 20 companies annually.
- The Lawrence Kinlin School of Business, which is in the process of building its own case study repository. A challenge is often finding subjects, and Riipen has been identified as a potential tool to alleviate our rising demand for subject material.

Lisa Wells: I think that this would be an excellent teaching tool, and I think we should implement it. We have learned that we must consider carefully what we ask students to produce and upload onto Riipen for their client to see. We may want to develop a filtering process in the future.

As a college, we are also considering adopting Riipen or a similar product as a tool to capture

and track experiential learning projects across the college for all academic schools and regional campuses. We will be having a broader discussion with all academic managers about that idea. We will need to engage more with the vendor to better understand licensing costs, supports, and training for users.

Lessons Learned

Lessons Learned

- As a purpose-built software application with a growing user base and track record, Riipen should be considered for post-secondary institutions interested in providing structure, a database, and a tracking system for experiential learning. We have not compared this product to others that may be in the same space so cannot comment on comparative advantage or benefits.

La Cite Collegiale

Project Description

The original project objective was to test Riipen in multiple ways. The first opportunity was to do so in a traditional sense where faculty members would submit projects to the platform and get some industry partners to sponsor them. The second opportunity was based on submitting areas of expertise tied to our applied research centre. This way, we could attract partners based on needs and build students projects in the context of those needs. We weren't very successful in either test. First, the fact that the software is English only made it difficult for our faculty members and students to fully use the power of the tool. Also, the majority of the partners in the platform prefer to sponsor English-language projects, thus making it a challenge to find matches for French-based projects.

Team Description

- Suzanne Gibault, executive director, Ideation and Creativity
- Michel Singh, senior advisor, Ideation and Creativity
- Nathalie Méthot, manager, Applied Research and Innovation
- Isabelle Tremblay, faculty member, Business Administration
- Sylvain Després, faculty member, Design
- Lynn Beaudoin, faculty member, Esthetics
- Olivier Chartrand, manager, Course Development
- Charles-André Masseboeuf, Business Development, Applied Research and Innovation
- Karen Bakker, Riipen
- Emily Masching, Riipen

We had various meetings to kick off the project with our applied research team, and we coordinated the publishing of our projects on Riipen. We focused on working with a small number of faculty members to get things started, and we thought we would target different domain areas. We also had regular calls with the customer success team at Riipen to follow up on how things were evolving.

Experiential Learning Details

We don't have a lot of data to share. What we can share is that we have evidence that it's a major

challenge for French institutions to integrate Riipen in their environment because of the language barrier. This fact has been communicated to Riipen and eCampusOntario. We are working on various ideas that could facilitate the use of the platform for francophones. At this point the discussions are at a very early stage, but we feel that one of the opportunities is to regroup French-language institutions together in order to engage a larger set of stakeholders in the conversation.

User Experience

We offered Riipen training to 35 faculty members as part of the pilot. This training was well received as we also covered the fundamentals of experiential learning. Out of these 35 faculty members, eight of them submitted projects to Riipen. On the downside, we did not get a positive match for any of these projects.

From an applied research perspective, we did submit two areas of expertise (bio-innovation and prototyping). We got some positive feedback from two industry partners looking for some help in the prototyping area. Unfortunately we weren't able to get any projects going. One of the partners had some very short-term needs that we could not address. The other partner was in the Niagara region and was looking for some specialized equipment, which made it impossible because of geographical reasons.

On the plus side, we did not have any technical issues with the platform, although we did not do any in-depth testing.

Value

The main value we got from our sandbox project was the opportunity to test an English-only tool in a French environment. The outcome from the project is positive because it can allow us to work with eCampusOntario and other partners to address this issue for Riipen and for other potential solutions.

Future Plans

We are looking at integrating more experiential learning opportunities within our curriculum. Our course development team is focused on building capacity with our business development team in order to get more opportunities to students. We would like to use Riipen as a tool of choice to gather, manage, and promote our class projects with industry partners. For this to happen, we need the

platform to be translated and we also need to foster a French ecosystem of industry partners. We have already engaged with eCampusOntario in this work.

Lessons Learned

Lessons Learned

- Train your faculty on the tool and on the potential of their already-existing class projects being transformed into experiential learning opportunities.
- Get faculty inspired by looking at what professors from other institutions are doing on Riipen. There is a long list of projects in Riipen that are available covering a wide range of domain areas.
- Coordinate efforts with the business development team and with placement services. It's very helpful to have a common approach when working with external partners.

University of Windsor

Project Description

The Faculty of Science is launching new opportunities to help students develop marketable skills in communication, lab management, safety, business, and entrepreneurship. Beginning in 2018, all undergraduate science students at the university have the opportunity to complete an internship that will provide them with real-life experiential learning opportunities. The project is providing value-added services to rapidly growing local industries: wineries, breweries, and greenhouses. We saw Riipen as an ideal partner to help achieve our goal of providing experiential learning to all science undergraduate students, helping to provide such experiences at scale and potentially beyond the local market. We also saw using the Riipen platform as a way to engage more of our local industries in partnerships with the university that have mutual benefit for the community and the university. This expansion of our outreach is a strategic priority for both the Faculty of Science and the university (as articulated in our strategic plan and our strategic mandate agreement, and as such, we saw a partnership with Riipen as a natural fit in a process we are already committed to.

As described below, due to a number of factors, the project could not be considered successful in achieving its original goals. Individual faculty were, for the most part, not yet ready to imagine incorporating experiential learning in the form of micro-experiences in their courses. They saw it as too much work or not fitting with their traditional science curriculums. They also had concerns about the cost to industries of taking on students and the institutional cost if the project were to continue beyond the pilot phase. As a result, no faculty from science took up the offer to use Riipen. One faculty member indicated interest, but was not teaching the course of interest again for over a year. The project was opened up to other faculties and one faculty member from business and one from the Faculty of Arts, Humanities and Social Sciences (FAHSS) indicated interest. The program in FAHSS is still waiting formal approval so was outside the time frame for the pilot. The business professor went through the whole process of defining and setting up a project, but ultimately decided it was too much for his course and withdrew.

While the project did not achieve its intended goals, a lot was learned about the potential barriers to implementing a project like this at our institution. In that respect, it could be considered that useful lessons were learned. The key challenges were twofold: (1) faculty concern about the workload required to successfully develop and implement micro-experiences with Riipen, and (2) concern about the ongoing costs of the tool, both to potential industry partners and to the institution. There was also some concern from the experiential learning office on campus that micro-experiences, especially if facilitated by a third party in collaboration with faculty directly, would potentially overlap with their work and make placements for co-op and internships harder to achieve.

Team Description

The broader project team consisted of the Faculty of Science's extension science team, with representation from the dean's office, departments, students, TAs/GAs in the courses, and the Office of Open Learning. The faculty team includes science outreach and communication officers who assisted in developing a communication model and engaging stakeholders.

Several industry engagement events were held with partners from the greenhouse, nutraceuticals, and alcohol industries to raise awareness of and discuss possibilities for experiential learning opportunities, including mutual benefits. Faculty travelled to several local industries and met with leaders in these fields. Workshops were also held with faculty members and senior leadership to raise awareness of Riipen. Faculty were invited to discussions and to individual consultations to attempt to determine ways that Riipen could be included in individual courses.

The Faculty of Science has started a curriculum mapping exercise for all undergraduate programs and is using that process to help identify opportunities to involve Riipen and other experiential learning opportunities. There was also a plan to gather student feedback from students, industry, and faculty on their experience with Riipen through short surveys and focus groups.

Experiential Learning Details

As described above, the project was not successful in developing any Riipen experiences in the Faculty of Science as was intended, and the only faculty member (from business) who committed to developing an assignment eventually withdrew. For science disciplines, the notion of micro-experiential learning was largely considered too foreign to their disciplinary pedagogies to be reconciled. This was exacerbated by there being few examples of assignments we could draw on to show some of the disciplines what a project might look like.

The Faculty of Science has subsequently developed two full experiential learning courses providing co-op and internship to science students, and a third is under development in one department just for their students. In all cases, developing a course just for experiential learning relieved faculty of the need to be involved in their own courses, and thus was more palatable to them. Most faculty did not believe that the learning outcomes in most existing courses could be easily supported by experiential learning opportunities. Beyond this, they had real concerns about the fiscal resources required to support the project beyond the pilot and, as a result, saw it as high risk to be involved.

User Experience

An additional challenge was that policy changes, new procedures, and lack of IT capacity during the implementation of our new ERP system made it impossible to integrate Riipen into the learning management system (LMS) or provide integrated sign-on. Beyond this, we experienced no technical issues with Riipen itself.

From a support perspective, pedagogical support required for effectively developing assignments mapped to the learning outcomes and curriculums of the faculty courses was significant. Developing these at scale would take considerable resources from already stretched pedagogical support on campus. Riipen does provide support to faculty to help them identify projects, but these still require significant instructional design to implement properly and most faculty were not willing to invest that time, particularly if the project was a pilot and may not be available long-term.

Value

As Riipen was not used in any classes during the sandbox trial, there is no student data available. Similarly, for faculty, as no one actually chose to adopt the tool, no data is available. However, instructors did share that they felt the system was too much work for them, and many found both the concept of experiential learning and including micro-projects in their courses unfamiliar and challenging. They struggled to see the value for their students as a trade-off in lost time learning in more traditional ways.

This may be a disciplinary challenge, with most science instructors having little exposure to these ideas in their own careers as students, and different types of experiential learning already embedded in their programming (e.g., labs, field trips, research) that are seen as more valuable than projects based in industry.

Future Plans

Despite the challenges, the Faculty of Science hopes to undertake a longer trial and has received additional funding to do so. Additional industry engagement sessions have been planned to help inform industry partners about the potential, and additional workshops and one-on-one support are being offered to faculty who may be interested. A full privacy impact and risk assessment will need to be undertaken to continue, and it is possible that IT resources will be available to integrate Riipen with other systems, including the LMS. Additionally, the funding will allow for more disciplines to be exposed to Riipen, and there may be more interest from some of those areas.

Lessons Learned

Lessons Learned

- It is easy to underestimate how conceptually challenging micro-experiences may be for some disciplines. Those who are not familiar with the notion of experiential learning as it is more broadly understood may struggle to see value in the Riipen process, especially in comparison to the amount of work they perceive it will take to set up and run the projects.
- Setting up Riipen experiences and successfully getting them through to students actually completing them takes much longer than anticipated, and requires much more instructional design, coaching, and support than was anticipated. Scaling up this approach would be a significant challenge in our estimation, although once running, the process should take less maintenance in subsequent cycles.

Experiential Learning: Additional Resources

Spotlight on Ontario Institutions

Follow each of the links below to learn how different institutions in Ontario are putting their commitment to experiential learning into action.

- McMaster University's Centre for Continuing Education: Experiential Learning with Riipen
- Niagara College: Work-Integrated Learning Open Modules
- University of Toronto: Riipen Pilot

Appendix A: Badging at Ryerson University

Ryerson University aligned its badges to:

- Clifton Strengths Training
- ThriveRU Workshops
- The Graduate Professional Development in Teaching program

Clifton Strengths Training

Participants receive a badge for each of two workshops: Personal Strengths and Team Strengths, detailed below.

Badge Issued for
Workshop I
Attendance

Personal Strengths: Workshop I

Individuals who receive this badge will be able to:

- List their Top 5 Strengths.
- Feel more confident in how they can use their Strengths.
- Explain at least one (1) of their strengths in their own words.
- Describe the importance of understanding their Strengths.

Badge Issued for Workshop II Attendance

Team Strengths: Workshop II

Individuals who receive this badge will be able to:

- Feel more confident in how they can use their Strengths in a team setting.
- Explain the importance of having diverse strengths on a team.
- Explain how one of my strengths may be challenging to others.
- Identify the four (4) Clifton Strengths theme domains

ThriveRU Program Completed

This badge is awarded to participants who have attended all four ThriveRU workshops (Gratitude, Optimism, Self-Compassion, and Grit) and have submitted a reflection outlining their learning. Individuals who receive this badge will be able to:

THRIVERU Badge Issued by Ryerson University

- Describe the five aspects of ThriveRU that combine to build resiliency (mindfulness, gratitude, optimism, self-compassion, and grit [perseverance]).
- Describe at least one way to enhance happiness and build resilience in their own life.
- Explain at least one way that incorporating ThriveRU tools into their life impacts themselves and others.

Graduate Professional Development in Teaching Program – Level I

Level 1

Upon completion of Level 1, participants will be able to:

- Develop their teaching practice in the context of their own TA/GA role.
- Understand and apply principles of student engagement and classroom inclusivity.
- Investigate student learning in a university setting
- Develop a statement of teaching philosophy.
- Engage in a learning community made up of peers from across the university.

Level 1 comprises three components:

1. 1.8 hours of teaching development workshops facilitated by the Ryerson University Learning and Teaching Office or at the Departmental or Faculty level.
2. CILT 100 Learning and Teaching in Higher Education I, a 6-week (18-hour) course.
3. A 1,000 word reflection on the SEDA Values and Outcomes that incorporates experiences from both the workshops and CILT 100.

Level 2

Upon completion of Level 2, participants will be able to:

- Design and deliver effective and engaging lessons.
- Design and develop a course outline based on stated learning outcomes.
- Develop appropriate assessments that assess the extent to which learning outcomes have been achieved.
- Develop a teaching dossier.
- Engage in a learning community made up of peers from across the university.

Level 2 comprises three components:

1. CILT 105 Learning and Teaching in Higher Education II, a 6-week (18-hour) course.
2. One of the following two options:15 to 24 hours of Course Instructor Apprenticeship where, under the supervision of a faculty mentor, participants gain practical experience in course instruction, exclusive of duties normally carried out by a GA or a 24- to 30-hour Instructional Skills Workshop (ISW), an intensive, peer-based workshop that runs over three days.
3. A 1,000 word reflection on the SEDA Values and Outcomes that incorporates experiences from CILT 105 and either the ISW or the Apprenticeship.

Follow-up Survey

Ryerson University's Student Life and Learning and Teaching Offices sent out the following survey post-pilot (A Google form, replicated here in the link and embedded):https://goo.gl/forms/cgiMkOhjuGNIZJkD

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=540

Appendix B: University of Waterloo Badges

Supporting Resources

Open Badge Workflow

University of Waterloo shared its PowerPoint presentation:

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=283

The Academic Integrity Questionnaire

The university badged its learning for academic integrity:

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=283

Participant Email

The university shared its communication to students:

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=283

Appendix C1: Badging Variety at Western University

An interactive or media element has been excluded from this version of the text. You can view it online here:

https://ecampusontario.pressbooks.pub/edtechsandbox/?p=570

Ivey Business School

Badge name and type: Engineering Economics, Curricular, Pre-curricular

Description: The Engineering Economics badge acknowledges completion of an online module covering key knowledge areas for engineering students: Time Value of Money, Present Value, Future Value, and Rates of Return, including Minimum Acceptable Rate of Return (MARR), Internal Rate of Return (IRR), and External Rate of Return (ERR). Students must score full marks in the end-of-module assessment to earn this badge.

Badge stats:

- Badges issued: 97
- Potential badge earners: 557
- Badge adoption rate: 17.4%

Badge criteria:

- Successful consumption of the material provided.
- Successful answering of 10 out of 10 questions in the assessment provided.
- Unlimited opportunities to complete this badge.

Badge application assessment method: Multiple-choice assessment

Constellation structure: Not applicable

School of Graduate and Postdoctoral Studies

Badge name and type: Leader Character, Professional development

Description: Explore the character dimensions of effective leadership and reflect on the leader you want to be as a doctorate holder.

Badge stats:

- Badges issued: 12
- Potential badge earners: 25
- Badge adoption: 48%

Badge criteria:

- Documented attendance and participation in the 12-week course SGPS9201: Developing Leader Character.
- A written reflection on your character strengths and the areas you plan to develop further in graduate school. This includes a vision statement of the type of leader you want to become and how you will measure your success.
- Creation and facilitation of a workshop that explores one of the following leader character dimensions: humility, integrity, collaboration, justice, courage, temperance, accountability, humanity, transcendence, judgment.

Badge application assessment method: The criteria for the badge were also requirements for passing the SGPS 9201 course. The course instructor tracked completion of these criteria and provided a list of names of students who received passing grades in the course. The badge was offered to these students. Students were asked to fill in the information about the workshop they developed and facilitated when they applied to the badge.

Constellation structure: Not applicable

Western University: Centre for Teaching and Learning

Badge 1 name and type: Lesson Designer, Professional Development

Description: Design a mini-lesson using principles of online learning (e.g., building community, constructive alignment, integrating and selecting technology) as presented in Instructional Skills Workshop Online at Western University. Participants can apply for a badge after completing all

required activities for weeks 1 through 3 of ISW-O, culminating with the submission of the BOPPPS Lesson Planner.

Badge stats:

- Badges issued: 3
- Potential badge earners: 9
- Badge adoption rate: 33%

Badge criteria:

- Complete voice.
- Thread activities.
- Introduce yourself.
- Strategies for building community.
- Sharing your golden nugget complete self-assessments:
    - Week 1 self-assessment
    - Week 2 self-assessment
    - Week 3 self-assessment
- Complete BOPPPS lesson planner.

Badge application assessment method:

- Badge earner self-reported completion.
- Badge criteria are all requirements for first three weeks of ISW-O, which we were already tracking, so could verify self-report.
- We initially wanted earners to submit their BOPPPS lesson planner but the attach feature was not working so we used check boxes.

Constellation structure:

- Hierarchical design
- Lesson Designer, weeks 1 through 3 of Instructional Skills Workshop Online, including lesson plan

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Badge 2 name and type: Lesson Facilitator, Professional Development

Description: Facilitate an online mini-lesson during Instructional Skills Workshop Online, and provide feedback as a learner on other mini-lessons. Participants can apply for a badge after

completing the required activities for weeks 4 through 6 of ISW-O, culminating with participation in synchronous feedback sessions.

Badge stats:

- Badges issued: 3
- Potential badge earners: 9
- Badge adoption rate: 33%

Badge criteria:

- Facilitate your mini-lesson.
- Participate as a learner in three or four mini-lessons.
- Complete self-assessments:
  - Week 4 self-assessment
  - Week 5 self-assessment
  - Week 6 self-assessment
- Participate in synchronous feedback sessions.
- Answer a reflection question: What do you want to take forward from your experience as an ISW-O participant to your own online teaching?

Badge application assessment method:

- Badge earner self-reported completion.
- Badge criteria are all requirements for weeks 4 through 6 of ISW-O, which we were already tracking, so could verify self-report.
- Participants submit an answer to a reflection question.

Constellation structure:

- Hierarchical design
- Lesson Designer, weeks 4 through 6 of Instructional Skills Workshop Online

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Badge 3 name and type: eLearning Lunch and Learn, Professional Development

Description: A Western University eLearning Lunch and Learn community member is a faculty or staff member who has been a regular attendee of the Teaching Support Centre's eLearning Lunch and Learn Series, and who has given consideration to how the series has contributed to their teaching practices.

Badge stats:

- Badges issued: 2
- Potential badge earners: 25
- Badge adoption rate: 8%

Badge criteria:

- Documented attendance at a minimum of three Lunch and Learn Sessions in the last two years (e.g., three sessions offered in 2016–17 and 2017–18).
- A written reflection demonstrating how your participation in the Lunch and Learn series has contributed to your teaching practices.

Badge application assessment method:

- Badge earner self-reported completion (check boxes).
- Participants answer a reflection question which is reviewed by the issuer.

Constellation structure: Standalone

Western University: Continuing Studies

Badge 1 name and type: WCS Learning Community: Participate, Professional Development

Description: The Western Continuing Studies (WCS) Learning Community Badge series recognizes an instructor's commitment toward the continuing development and improvement of teaching techniques. The Participate Badge acknowledges the regular attendance and engagement in professional development opportunities offered through Western Continuing Studies in the 2017–18 academic year. These professional development opportunities are designed to offer instructors valuable skills and techniques that can be used to enhance the adult learning environment.

Badge stats:

- Badges issued: 11
- Potential badge earners: 40
- Badge adoption rate: 28%

Badge criteria:

- Must be a Western Continuing Studies instructor.
- Documented attendance of a minimum of two professional development sessions or Teaching

Adult Learning (TADL) courses in the last two years (January 2017 until present).

Badge application assessment method: Badge earners self-identified which sessions they attended since January 2017 (checklist was provided). Badge issuer verified attendance through class lists on file.

Constellation structure: Three badge series that require earners to complete the first one before earning the next:

- WCS Learning Community: Participate
- WCS Learning Community: Apply
- WCS Learning Community: Share

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Badge 2 name and type: WCS Learning Community: Apply, Professional Development

Description: The Western Continuing Studies (WCS) Learning Community badge series recognizes an instructor's commitment toward the continuing development and improvement of teaching techniques. The Apply Badge demonstrates how the participation in professional development opportunities offered through Western Continuing Studies has contributed to refining their teaching practice and enhance the learning experience for students.

Badge stats:

- Badges issued: 2
- Potential badge earners: 40
- Badge adoption rate: 5%

Badge criteria:

- Must be a Western Continuing Studies instructor.
- Earned the WCS Learning Community: Participate badge.
- Provided a written reflection highlighting elements from the sessions that you have been able to implement into your course.

Badge application assessment method:

- Reviewed verified that the previous badge was earned.
- Reflection was reviewed and where possible course elements were verified or program managers were consulted to see if they were aware of the skill/process being used.

Constellation structure: Three badge series that requires earner to complete the first one before earning the next:

- WCS Learning Community: Participate
- WCS Learning Community: Apply
- WCS Learning Community: Share

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Badge 3 name and type: WCS Learning Community: Share, Professional Development

Description: The Western Continuing Studies (WCS) Learning Community Badge series recognizes an instructor's commitment toward the continuing development and improvement of teaching techniques. The Share badge demonstrates the learner has shared knowledge, ideas, and experience with other members of the WCS learning community by being a part of a panel discussion on learning, facilitating a professional development session at WCS, or initiating a networking event with other WCS instructors.

Badge stats:

- Badges issued: 1
- Potential badge earners: 40
- Badge adoption rate: 3%

Badge criteria:

- Must be a Western Continuing Studies instructor.
- Earned the WCS Learning Community: Participate and Apply badges.
- Provided written documentation on how they have shared knowledge or experience with other members of the WCS learning community.

Badge application assessment method:

- Reviewer verified that the previous badge was earned.
- Reviewed and verified with the program manager that the sharing occurred between other WCS instructors and the meetings resulted in an improved student experience.

Constellation structure: Three badge series that requires earner to complete the first one before earning the next:

- WCS Learning Community: Participate
- WCS Learning Community: Apply
- WCS Learning Community: Share

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Badge 4 name and type: Lesson Designer, Professional Development

Description: The Design Thinking badge acknowledges the learner's ability to explore a design method for tackling challenges and creating customer-driven solutions. The earner of this badge has actively engaged in hands-on design-thinking activities as he or she moves through the various phases of design thinking (empathize, define, ideate, prototype, test).

Badge stats:

- Badges issued: 11
- Potential badge earners: 70
- Badge adoption rate: 16%

Badge criteria:

- Successful completion of BSMG6206 Design Thinking course.
- Written explanation demonstrating how design thinking has or will contribute to achieving an innovation solution to a challenge faced by your organization (between 500 to 1,000 words).

The reflection should briefly identify a user's feeling toward the student's product/service. It should clearly define the challenge, ideate process, and prototype process. The reflection should indicate if the solution was successful (or how they plan to test the success). Students were also encouraged to share any documents created in the process (i.e. empathy, journey or concept maps).

Badge application assessment method: Students identified the section of the course they attended, and I verified to ensure they received a pass/complete for the course. The reflection paper was reviewed by the issuer of the badge. The issuer of the badge had previously completed the course and was aware of the criteria that was to be met. It did not happen, but if the issuer was unsure of if the person should receive a badge, she reached out to other staff members who completed the course. Although the instructors were not contacted, we did notify that a pilot project was underway and if we had questions about design thinking that we might reach out to them.

Constellation structure: Standalone

Appendix C2: Ivey Business School Debrief on Badges

Ivey Business School at Western University shared its PowerPoint slide deck (as a PDF)

An interactive or media element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/edtechsandbox/?p=203

Appendix D: Canadore College Survey Responses

Canadore included the breakdown of answers to eCampusOntario's fifth question on its required reporting of Labster's virtual lab simulations.

Question 5

> **Value:** Describe the methodologies and results from the data gathered from your virtual simulations audience. Include any survey instruments or other supporting documents as attachments. Describe how you will communicate these results back to your community.

What learners like about the simulations

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=232

What learners dislike about the simulations

An interactive or media element has been excluded from this version of the text. You can view it online here:
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Proposed changes to simulations

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Overall contribution to learning

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=232

Appendix E: Sault College Virtual Lab Simulations Integration Details

Integration details

- Labs used
- Equilibrium
- Acids and Bases
- Titration

How labs were integrated: As a final lab assignment, students were asked to complete at least one of the three simulations and then provide feedback about their experiences using a virtual lab. Most students elected to complete two out of the three labs: only the highest mark contributed to the final grade. In this particular course, the students had already completed lectures, tests, and wet lab investigations involving these three topics. Thus, the virtual labs served as a review of concepts and techniques already covered.

Number of educators using: 1

Number of learners impacted: 20

Learner perspective:

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=245

Educator perspective:

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https://ecampusontario.pressbooks.pub/edtechsandbox/?p=245