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Navigating large foundational classes: Providing scalable infrastructure for next generation blended learning classrooms to enhance student learning outcomes, access and choice

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Navigating large foundational classes:

Providing scalable infrastructure for next generation blended learning classrooms to enhance student learning outcomes, access and choice

A Ministry of Training, Colleges and Universities Initiative

June, 2014

Navigating large foundational classes: Providing scalable infrastructure for next generation blended learning classrooms to enhance student learning outcomes, access and choice

Extracts from final report to the Ministry for Training, Colleges and Universities

Prepared by Nick Baker

Office of Open Learning

University of Windsor

Executive Summary

Universities across the Province and around the world are struggling to meet the challenges of supporting a rapidly expanding, diverse, digitally literate, and time-poor student population who view education as a service for which they are paying (Garrison & Kanuka, 2004). As class sizes continue to grow and public funds available for expansion of physical campuses decline, there is an urgent need for universities to seek innovative and efficient approaches to utilisation of their existing spaces, leveraging technological and pedagogical advances to continue to provide high quality learning experiences for increasing numbers of students (Bates and Sangra, 2011; Owston, 2013).

Recent research (Carey and Trick, 2013; COHERE, 2011; Owston, 2013) has highlighted the value of teaching and learning approaches that blend digital or online elements with traditional face-to-face contact with educators and peers. This is particularly the case in large undergraduate classes (Kerr, 2011), where students often feel isolated and disconnected from their instructor, peers and the University. Blended learning and 'flipped' classes offer the opportunity to provide large classes with experiences similar to those in small classrooms by making better use of face to face interaction time to engage in more active learning approaches (for example, problem solving, scenarios, peer teaching, and mentoring).

Garrison and Kanuka (2004) point out the potential transformative nature of blended learning in the context of challenges facing higher education in Canada. They argue that blended learning approaches can facilitate necessary changes to redefine higher education institutions as student and learning centred communities that are outcomes focussed and facilitate higher learning experiences. The majority of Canadian universities do have web-based components in many of their courses (McGreal and Anderson, 2007), however, few institutions have taken this approach systematically across curricula, and therefore most have failed to harness the transformative power of this approach. Blended learning has the potential to help universities meet the demands of educating larger, more diverse student audiences using pedagogical approaches that not only utilise the most appropriate technologies, but which also facilitate learner autonomy and development of lifelong learning strategies that 21st Century students will require to compete in and contribute to a knowledge-based society (Garrison & Vaughan, 2008; Hicks, Reid & George, 2001). Blended learning has also been shown to offer advantages including higher student achievement and satisfaction compared to traditional or fully online courses, stronger engagement of faculty, and more efficient use of space (Owston, 2013; Means, et al. 2010).

The project focused on the Ministry's Priorities 2.1 (transforming foundational courses) and 2.3 (improving teaching quality), and University of Windsor's 2012 SMA Priority 1 (transforming large undergraduate courses). It aimed to transform a subset of the University's largest undergraduate courses (typically first year or foundational courses), critical course bottlenecks, and traditionally challenging courses by providing the infrastructure required to support technology-enabled blended learning in those courses. When complete, it will see an initial 15 classrooms across campus enabled with lecture capture technology to automatically produce engaging, rich media recordings of learning experiences that can be reviewed, annotated, and discussed on demand. It will also integrate online student engagement and learning analytics tools into the curriculum that will help to provide rich feedback loops to instructors and students about the learning that is occurring in their classrooms. It will develop a framework and infrastructure as a proof of concept for expansion of this curricular transformation that can be implemented rapidly across the University and begin to define the University of Windsor Advantage – those elements of the educational experience that will make Windsor uniquely attractive to students. It will reduce costs to the students by offering a student engagement system that is centrally funded (as opposed to current student response systems that are student purchased), and seeking open educational resources including open textbooks

or low-cost eTexts. Resources developed, such as the course curriculum frameworks, and professional development resources for faculty can be shared locally within UWindsor, and provincially with other institutions.

This project allowed the University of Windsor to leapfrog potentially years of piecemeal investment in technology that combined would not be able to significantly impact the culture of the institution to evolve to the necessary next state. It represents a critical investment for the University to enable it to achieve its goals of transforming the undergraduate experience, becoming an institution that offers students true flexibility and choice in their learning, respecting and welcoming students with diverse needs and backgrounds, and focusing on excellence in education that embraces technological and pedagogical innovation.

Total funding received from MTCU for this project was **$349, 925**.

Innovation & Productivity

The project offered a once-in-a-generation opportunity to make significant pedagogical change possible through intelligent investment in strategic technologies. In times of fiscal restraint, universities usually lack the significant funds required to make strategic investments in technology and infrastructure that can lead to greater efficiencies, productivity, innovation, and cultural change (Roby et al. 2013). MTCU has clearly signalled that they wish to support such outcomes and that these are critical for the future of higher education in Ontario, and the University of Windsor is embracing this through investment in student centred pedagogical change, renewal and development of new approaches to serving the needs of our students.

Several recent reports (e.g. COHERE, 2011; Carey and Trick, 2013) have identified the lack of focus in Canadian institutions on pedagogical and technological innovation, and the relative risk that poses to the viability of our institutions both for the local market, and the international market, which is expected to become an increasingly important source of revenue for Ontario and Canadian universities. Blended learning approaches represent a relatively low-risk, high return strategy that position universities well to develop further as technology drives societal change and fundamentally alters the way in which we communicate, teach and learn (Garrison and Kanuka, 2004). But there are barriers to their adoption from a faculty perspective. First and foremost, the technology must not represent a barrier in itself; it should be almost invisible and become a very minor part of what faculty have to consider when designing their educational environments. Secondly, there is a lack of sound empirical evidence for the impact of many educational technologies (despite there being considerable literature in the field) that can convince faculty of its worth. Third, most faculty are experts in their disciplines, not in pedagogy and so initial support for faculty in building capacity is critical. This project will address these challenges by providing appropriate technology, automating processes wherever possible, and providing initial pedagogical support to design modern and effective learning environments. The data collected during the project will be used to support the expansion of blended approaches across the University.

This project proposed investing in technologies with multiple purposes and potential beneficial outcomes at the institutional level, while also recognising the human element of innovation and productivity which is driven by culture and perceptions of support for this work (Roby et al. 2013; Owston, 2013). The core processes by which this project will support the goals of the PIF include:

1. Reduced student attrition (increased retention): achieved through improvements in student satisfaction, intellectual challenge, peer to peer and student-instructor interaction, greater time on task, increased

student and faculty engagement, and improved student-institutional fit (Rovai, 2003; Berger & Braxton, 1998).

2. Retention of highly engaged faculty: recruiting faculty is an expensive exercise, and retaining them and keeping them highly motivated to teach and creatively engage in the endeavours of the university is organisationally important (Bohle Carbonell et al. 2013).
3. Increased efficiency of delivery: while the overall cost of instruction and delivery remains the same in blended learning, the outcomes for students and faculty are greater, essentially providing greater return on investment.
4. Greater ability to track student achievement: Implementing authentic, aligned assessment strategies and tools such as ePortfolios allows for better tracking of achievement against stated learning outcomes.
5. Reduction in bottlenecks in student progression pathways: Most courses currently have caps and other restrictions that can lead to bottlenecks in student progression. Using blended approaches provides the ability to increase caps while still achieving high quality educational outcomes.
6. Increased choice, flexibility, ability to reduce number of years of study: increasing blended offerings allows for more students to get access to the courses they want to study (and need as noted above), increasing program satisfaction and progression rates. Offering more courses over the three terms using the blended learning design can reduce the overall time to completion, another goal of the MTCU.
7. Developing autonomous, self-regulated, lifelong learners needed for the knowledge economy through engagement with tools such as ePortfolios (Cheng and Chau, 2013), and 'flipped' classroom pedagogical approaches.
8. Provision of tools to allow for pedagogical innovation: When faculty are given the tools and support needed to be creative in their teaching, the opportunity for innovation improves (Bohle Carbonell et al. 2013).
9. Improved use of space: Institutional spaces can be used more efficiently if less face to face time is required, effectively allowing for more students to be taught with the same space allocations (Dzuiban et al. 2011)

Overall, this project will enhance institutional efficiency, reinvigorate and renew pedagogies, and provide a better experience for students through key strategic infrastructure investments.

Project Overview

Successful pedagogical change can be facilitated by providing access to appropriate technology and pedagogical supports (Bates and Sangra, 2011; Garrison & Kanuka, 2004). The purpose of this project was to identify and implement infrastructure required to expand blended learning approaches across the University, and to enable pedagogical innovation through provision of effective tools to support the needs of innovators. Initially, the 25 largest courses for the past 5 years were identified and all instructors who had taught these courses were approached about the project. This was later expanded to all courses with enrolments >100 students in the past 5 years.

The first priority of the University of Windsor's 2012 SMA was *Transforming the large classroom experience*. This project contributed to the achievement of this goal by development of critical technological and pedagogical capacity. The project sought to develop a framework for an approach to blended learning that supports active learning, high levels of engagement, and authentic assessment of student learning that can be implemented at the institutional level, or made available to other institutions for incorporation in their own curricula.

Adapting existing course design principles and models, such as Garrison and Vaughan's (2008) work institutional resources for instructors interested in blended course design in undergraduate classes were developed and beta tested with faculty through a Blended Learning Course Design Institute and several workshops. Design elements addressed include:

a. Design for student engagement ;
b. Authentic and effective assessment practices;
c. Peer and instructor feedback;
d. Selecting and utilising the most effective technologies to support efficient, autonomous learning;
e. Utilising appropriate tools and approaches to develop digital literacies.

These pedagogical aspirations were supported by provision of appropriate educational technologies to a broad cross-section of the institution. The technologies chosen were in part selected for their shallow learning curve, relatively low maintenance cost, efficient support requirements, and ability to seamlessly integrate into existing systems. The technology components of the project included:

1. Providing **automatic lecture capture** capabilities in the 15 largest classrooms on campus, as well as other classrooms that facilitate different styles of learning and teaching. Lecture capturing is currently being piloted in classes that use these rooms, with priority for scheduling given to classes who are aiming to use the system;
2. **Providing lecture streaming capability or integrating lecture capture tools** with our existing web conferencing solution for delivery to remote learners or those not able to be in the physical classroom. This facilitates flexible approaches to learning that are not currently possible on a large scale, providing students with the opportunity to make decisions about their own preferred learning method;
3. Recordings will be made available to students for **review, annotation, discussion and study purposes,** and to instructors for their own pedagogical review;
4. For courses with on-campus, hybrid and distance learners, it is now possible to provide a **common set of lecture resources**, **reducing costs** of recreating those materials, and for those who are able to, the live classes can be streamed to any location with an internet connection and viewed on any web-enabled device;
5. Providing each instructional team with access to a **common suite of technology tools** for designing and delivering engaging classes including computing equipment, tablets, web cameras, microphones, drawing tablets, and personal lecture capturing software;
6. Developing an **Electronic Course Outline System** and associated workflow processes that will allow for consistency in the course-related information that students receive (including about delivery mode), and which can aid students in deciding on courses by making many elements of syllabi available before enrolment;
7. Developing **course frameworks** for large classes that can be shared;
8. Expanding the use of **e-Portfolios** to larger classes to allow for more holistic, authentic assessment of student achievement of learning outcomes;

The project also involved developing a **community of practice** of instructors who teach or who are interested in teaching large blended classes. This interdisciplinary group will share pedagogies and strategies, and support each other in their teaching. All resources developed throughout this project will eventually be shared online through a Creative Commons licence.

Achieving the broad aims of the project

This project allowed Windsor to invest in technologies with multiple purposes and potential beneficial outcomes at the institutional level, while also recognising the human element of innovation and productivity, which is driven by culture and perceptions of support for this work (Roby et al. 2013; Owston, 2013). The core processes by which this project supported the goals of the Productivity and Innovation Fund included:

1. Reduced student attrition (increased retention): achieved through improvements in student satisfaction, intellectual challenge, peer to peer and student-instructor interaction, greater time on task, increased student and faculty engagement, and improved student-institutional fit (Rovai, 2003; Berger & Braxton, 1998).

   Outcome: *It will be some time before the full impact can be assessed as many of the sub-projects involved creating new courses, or new versions of existing courses, which have to go through internal quality assurance and administrative procedures. Most redesigned courses will run in Fall 2014 or Winter 2015, but some have piloted for Summer 2014. Courses that are currently using the new tools are replacing older student response systems ('clickers') with Lecture Tools as a student engagement tool. Other courses are also using the new lecture capturing capabilities, either in the classroom or from a desktop. These tools are generating learning analytics data that will demonstrate impact on student engagement and learning. We will also track student drop-rates from these courses as they come online for comparison with previous versions of the course, and the general UWindsor student population. Data collection is ongoing in these courses, but initial feedback has been highly positive from faculty and students.*
2. Retention of highly engaged faculty: recruiting faculty is an expensive exercise, and retaining them and keeping them highly motivated to teach and creatively engage in the endeavours of the university is organisationally important (Bohle Carbonell et al. 2013).

   Outcome: *New faculty who had just joined the University were invited to participate in the project and their support and willingness to explore the possibilities of the approaches to teaching facilitated by the new technology available has been encouraging. Some of these faculty were able to change their courses for the Summer term to implement the new technologies, and feedback so far has been highly positive.*
3. Increased efficiency of delivery: while the overall cost of instruction and delivery remains the same in blended learning, the outcomes for students and faculty are greater, essentially providing greater return on investment.

   Outcome: *Return on the investment will take time to be visible as the new courses come online. As an example, however, all of the courses designed under this project have significantly less face-to-face instruction, requiring less access to a physical classroom. This allows for those rooms to be utilised more efficiently for courses. In addition, some departments are exploring options for using rooms equipped with lecture capturing technology and streaming live from the room so that students have the option of attending or not. This potentially reduces the need for additional sections, while giving the students the choice to learn in the way that best suits their needs.*
4. Greater ability to track student achievement: Implementing authentic, aligned assessment strategies and tools such as ePortfolios allows for better tracking of achievement against stated learning outcomes.

   Outcome: *An ePortfolio solution that is very cost effective, utilising two open source products (WordPress and Drupal) was implemented and made available to programs that had been investigating commercial solutions. For example, the Visual Arts and Built Environment program is accredited every 4 years by the National Architecture Accrediting Board (NAAB). This currently requires several days of onsite review, presentation of paper-based files, and student portfolios. Using the ePortfolio system, the use of paper will be reduced, students will be able to display more work, and accreditors can begin the review prior to the onsite visit. As another example, the Faculty of Law offers a clinic course that has not previously been for credit because of the challenges of assessing learning beyond traditional paper-based exams that the program traditionally uses. By implementing an ePortfolio, students will be able to gain credit for their learning in the course as an holistic assessment of learning will be possible for the first time.*
5. Reduction in bottlenecks in student progression pathways: Most courses currently have caps and other restrictions that can lead to bottlenecks in student progression. Using blended approaches provides the ability to increase caps while still achieving high quality educational outcomes.

   Outcome: *The courses addressed in this project are currently still under development. All courses under development have significantly reduced face-to-face requirements, and some courses offer optional attendance. This is expected to increase their availability to students as classes will not be constrained as much by timetables or student conflicts. These changes also provide greater flexibility for non-major students who may be able to take some of these courses as electives.*

6. Increased choice, flexibility, ability to reduce number of years of study: increasing blended offerings allows for more students to get access to the courses they want to study (and need as noted above), increasing program satisfaction and progression rates. Offering more courses over the three terms using the blended learning design can reduce the overall time to completion, another goal of the MTCU.

   Outcome: *Offering core courses in more terms wherever possible, and in flexible modes wherever possible, will reduce the number of students who are not able to progress because of timetable or pre-requisite limitations. This project has identified core courses in a number of programs that are targeted for development as flexible delivery offerings. In some disciplines, non-core elective courses are the target and will develop proof of concept versions for offering in Fall 2014 or Winter 2015.*
7. Developing autonomous, self-regulated, lifelong learners needed for the knowledge economy through engagement with tools such as ePortfolios (Cheng and Chau, 2013), and 'flipped' classroom pedagogical approaches.

   Outcome: *Developing a learning portfolio is now included as part of several programs as a result of this project, including Visual Arts, Sonic Arts, Visual Arts and Built Environment, Law, Nursing and Business Leadership. Flipped classroom approaches are being trialled in Business (Finance, Marketing, Leadership and Accounting), Economics, Math, Engineering, Social Work, Psychology and English Language and Literatures. In courses that are currently running, some students find the autonomous learning approach challenging, but the overall feedback has been positive for first-run courses.*
8. Provision of tools to allow for pedagogical innovation: When faculty are given the tools and support needed to be creative in their teaching, the opportunity for innovation improves (Bohle Carbonell et al. 2013).

   Outcome: *Creativity and quality in teaching have been hampered by lack of access to the robust technological and pedagogical tools needed to support such approaches. This project has provided instructors at Windsor with access to the tools they need to reimagine their curricula, and many are experimenting with change in a way that would not have been possible otherwise.*
9. Improved use of space: Institutional spaces can be used more efficiently if less face to face time is required, effectively allowing for more students to be taught with the same space allocations (Dzuiban et al. 2011).

   Outcome: *Several courses will be able to share the same space that would previously have been taken with one course. Instructors teaching such courses will need to be able to request an appropriate space for on campus classes, which may also lead to more efficient use of space and better outcomes for students learning in the best setting for the content. A process is being developed to allow for better allocation of teaching spaces, which is also needed for the technical scheduling of lecture capturing in courses.*

Project Outcomes

This project aimed to address the PIF priorities 2.1 and 2.3, as well as Windsor's Strategic Mandate Agreement goal of improving the experience of students in large undergraduate courses. Some predicted outcomes for students and instructors will not be visible in the short term, but in the medium to long-term, the support this project has provided to the University will transform the possibilities available for teaching and learning.

The specific outcomes of the project and a summary of achievement are provided here:

1. Identify suitable solutions/products for key technological infrastructure (including automatic lecture capture, student engagement tools, learning analytics, personal instructor technologies, ePortfolios and an electronic common course syllabus system) required to support blended learning in institutionally significant courses (large courses, bottlenecks);

   Outcome: *Echo360 and Lecture Tools were selected as the institutional student engagement platform providing lecture capturing and personal lecture recording capabilities for the campus. The open source tools WordPress and Drupal were selected for developing ePortfolios and have been expanded to*

include more programs, with availability for all programs who wish to be involved. No commercial tool currently exists to provide the functionality required of the common course syllabus system (known as the Electronic Course Outline System (eCOS), so it is being built to integrate with our existing and planned future systems.

2. Purchase and implement rollout of these technologies in 15 classrooms across campus

   Outcome: *The Echo360 solution provides both software and hardware based solutions for lecture capturing. Using the combination of these, we will have our 17 largest classrooms, plus an additional 12 classrooms enabled by the fall 2014 term. Several of these classrooms were already scheduled for upgrades or renovations, and the system will be installed as part of any planned upgrades to minimise disruption in classroom availability. Lecture Tools is being piloted in several courses over the summer term, while Echo360 is also being piloted for courses where rooms are available, and where not, using desktop-based personal capture.*

3. Identify at least 25 strategic pilot courses in programs where blended learning approaches are most appropriate, which will contribute to solving access bottlenecks for existing students, and which will offer greater enrolment choice and opportunity for new students;

   Outcome: *The 25 largest courses taught on campus were identified and their instructors were invited to participate in the Blended Learning Design Institute and the broader project. This was later expanded to all courses with consistent enrolments >100 students currently taught in face-to-face mode.*

4. Simultaneously develop blended learning course framework that can be applied across disciplines and shared provincially with other institutions;

   Outcome: *An initial framework, based on work from institutions in Australia and other well-recognised guides internationally, as well as Windsor's local context, was developed and shared with participants in the Blended Learning Design Institute, and other workshops related to the project. It is subsequently being refined for release as a Creative Commons licenced open access resource.*

5. Design and develop an Electronic Common Course Syllabus System to standardise information available to students prior to enrolment;

   Outcome: *Investigations of the market have not found a suitable commercial product for this role, and so developing a system in-house is required. This is a considerable undertaking, with technical, cultural and administrative challenges. Two pilot faculties, and the required elements of the system have been identified. Technical development is ongoing and some elements will be affected by the implementation of a new LMS and ERP system over the next year.*

6. Expand existing ePortfolio pilot to first year courses involved in the blended learning pilot to enhance learning and holistic assessment opportunities;

   Outcome: *ePortfolio pilot was expanded to open access to the campus. It is now being used in 4 of 7 faculties and for multiple purposes.*

7. Develop a suite of professional development activities and tools to support faculty in their development of blended learning courses using the defined framework (also shareable across the Province);

   Outcome: *A 3-day Blended Learning Design Institute was designed and delivered, along with a 1-day Online and Blended Learning Symposium, numerous workshops (either open or situated for a specific group), and hundreds of hours of one-on-one or small group consultation and mentoring have all been implemented on campus. Online resources are being refined and expanded based on feedback, and a new for-credit course in Blended Learning Pedagogy is being developed for delivery to instructors at Windsor and beyond.*

8. Take steps to develop a community of practice for blended learning instruction at Windsor;

   Outcome: *The Blended Learning Design Institute set up relationships across disciplines with likeminded individuals, as did the Online and Blended Learning Symposium. Working with the Teaching Leadership Chairs, the Peer Collaboration Network (a network of instructors who provide peer feedback on teaching practice) will be expanded to online and blended learning approaches, initially targeting new courses and instructors as they come online.*

9. Evaluate and disseminate outcomes widely locally and across the Province.

Outcome: *The project plan and preliminary results have been disseminated widely across the campus through several on-campus events including a Blended Learning Design Institute, Educational Leadership Forum, Odette Online and Blended Learning Symposium, 6 workshops, individual/group consultations, Campus Technology Day (conference), Ontario University Computing Conference, The Association for Authentic, Experiential and Evidence-based Learning (AAEEBL) Conference (Michigan), and the Ontario Universities Council on eLearning meeting. The project will also be presented on in part at the EdMedia Conference (Finland) and the Australasian Association of Educational Researchers Conference (Australia), all with acknowledgement of the support of MTCU/PIF. No expenses for these conferences were charged to the PIF grant.*

Metrics for success in the medium term include:

1. Improved student satisfaction (measured by the CLASSE instrument, Garrison and Vaughan's (2008) evaluation instrument, and NESSE results);

   Outcome: *The CLASSE and Garrison & Vaughan's instrument, along with focus groups and in some cases, evaluation of student work, will be used to measure student outcomes in the redesigned courses as they come online. In the longer term, it is expected that an impact may be seen on the NESSE results as more courses and programs take a more flexible and student-centred approach. Data collection and analysis is ongoing as classes have just begun and some are not planned to roll out new changes until 2015.*
2. Student achievement of learning outcomes as measured by course grades and cumulative GPA;

   Outcome: *This data will not be available until the redeveloped courses are offered.*
3. Increased faculty engagement in blended learning approaches (increasing from current levels) measured through faculty engagement survey and teacher belief survey;

   Outcome: *Faculty were surveyed at the beginning of the project using the Teaching Perspectives Inventory and the Technology, Pedagogy and Content Knowledge instruments. These will be repeated once the course development is complete for the first round of courses. Faculty were also invited to participate in focus groups that will be facilitated in Fall 2014. Students who take the redesigned courses will also be surveyed and asked to participate in focus groups. Faculty who utilised the ePortfolio system were surveyed independently, and students who used the system were also surveyed. Student and faculty satisfaction was generally high but survey response rate was low so it will be repeated in Fall 2014. Students were also asked to allow their ePortfolios to be investigated in a content analysis.*
4. Level of faculty interest in involvement in the pilot (number of faculty responding to the call);

   Outcome: *Over 20 faculty are working on designing or redesigning courses in a blended mode as a result of this project. Approximately 50 more faculty are actively using the various technologies this project afforded, with many more coming on board for subsequent terms once all the technologies are completely integrated to the campus. Every faculty on campus is represented with participants in this project. Four departments will offer blended courses for the first time in fall 2014 or winter 2015 as a result of this project, while others are expanding beyond their existing offerings using the new technology. A further two departments have begun program level design planning for blended postgraduate programs.*
5. Faculty satisfaction and changes in pedagogical approaches as a result of the project (for example through Approaches to Teaching Inventory (ATI);

   Outcome: *Formal and informal feedback from faculty indicates a high level of satisfaction with the training received and for those who have piloted the technologies and pedagogies in their classes already, the response from students has also been positive. As indicated above, faculty and student evaluation and data collection is ongoing, but preliminary results are positive.*
6. Uptake of faculty learning and development opportunities (number of faculty engaging in training and support offered).

   Outcome: I*nterest in the project was strong, well beyond the initial target audience. While the original plan was to focus only on the instructors in the largest courses, there was such strong interest*

from the rest of the campus that it was decided to open access more broadly to all instructors who were interested in engaging. There were a total of 181 enrolments in the workshops and learning events developed for this project, representing approximately 20% of the teaching complement of the University. In addition, hundreds of hours of one on one consultations were completed with individual faculty, department chairs and other administrators. Invited presentations on the project were also made to Deans' Council and Senate, and articles were published in the campus news and local media.

Potential cost-savings or cost-avoidance

It is projected that this project will contribute to increased revenue, cost savings for the institution, and avoid costs for students in a number of ways.

1. **Increasing student enrolment** through offering blended courses and programs that offer students flexibility while maintaining high quality education.

   Outcome: *As the new blended programs become available, and as the new courses come online, evidence of revenue generation will be available. It is currently too early to determine this impact.*

2. **Improving efficiency of space use.**

   Outcome: *While it is too early to predict the value of this, the potential is high as the new courses come online to make significant improvements in scheduling of physical class spaces. As an example, some of the redesigned courses are planning a blended approach where one physical section is offered in a large lecture theatre, but additional sections are offered with virtual attendance so instead of having to schedule multiple rooms for repeated lectures, those courses will need only one room equipped with the lecture capturing/streaming technologies. Other courses are planning to record and stream all lectures, making attendance voluntary and using a smaller room than would otherwise be needed. Further classes are planning to meet on a reduced schedule (bi-weekly or less), which has allowed multiple classes to be scheduled in the same rooms where alternate class schedules can be meshed.*

3. **Avoiding travel costs for students and faculty.**

   Outcome: *This will increase as more courses become available, but as an example, a new blended practicum course was offered this term in social work where over half of the students lived in the GTA, and one student was in Nunavut. The student in Nunavut attended all sessions virtually (she would otherwise have not been able to take the course), while the Toronto based students were offered flexibility in their attendance in Windsor. Those students attended approximately 50% of the classes virtually, saving collectively thousands of kilometres of travel and hundreds of dollars in gas.*

4. **Improving progression pathways.**

   Outcome: *It will take some time for this data to be evident, but several of the courses being developed are traditionally courses with higher failure rates and fewer annual offerings. The combination of increased offerings in alternate formats, and revised pedagogies is predicted to improve outcomes for students and lead to better progression rates.*

5. **Avoiding costs to students** of buying personal response systems (i.e. 'clickers').

   Outcome: *Two of the largest users of clickers on campus have moved to using the web-based student engagement tool as an alternative to clickers. This represents an average of nearly 1,000 students annually who do not have to purchase a clicker device, which currently range from $30-50 each. Additionally, one of the departments on campus who have the largest clicker use across the curriculum requested personalised training with the indication that several instructors wished to pilot the tools in their classes. This represents potentially another 600 students. Several other smaller classes are also using Lecture Tools as an alternative to clickers, with approximately another 400 students being impacted by these classes. Many of the larger users of clickers are fall or winter courses as well, and several of these instructors are also intending to pilot Lecture tools.*

Partnerships and Knowledge Sharing

In addition to the metrics above, external interest across the Province, nationally and internationally can be considered an indicator of success. In this respect, the project leader has provided consultation to eight other Ontario universities interested in possibly implementing the same technologies. A further three universities from three provinces have sought consultation with our project team, particularly on lecture capturing, and several US universities have consulted on the ePortfolio component of this project. The University of Windsor's project team has also consulted with one Ontario university and two US universities for assistance with developing best practices around the implementation of lecture capturing and the student engagement system.

The project results and process have also been disseminated widely in the local, national and international community, with presentations at one local conference, two provincial conferences, an invited presentation at a US conference, and an international conference in Europe.

Presentations and consultations included:

- Presentation at Ontario University Council on eLearning (OUCEL) conference
- Presentation at UWindsor Campus Technology Day (CTD) 2014
- Presentation at Ontario Universities Computing Conference (OUCC) 2014
- Presentation at the Association for Authentic, Experiential, and Evidence-Based Learning (AAEEEBL) North West 2014
- Consultation with Queens, UOIT, University of Saskatchewan, Mount Allison, OCADU, Dalhousie, UPEI, York, McMaster, Trent, Western, UofT.
- Collaboration with UOttawa and Wayne State University.

Appendix 1. Total registrants for all information dissemination experiences facilitated by the Navigating Large Classes PIF Project

Activity	Number of Registrants	Notes
Workshops		
Blended Learning Course Design Institute	37	Total registrants over 3 days
Introducing Echo360 and other technologies to the campus (x 3 sessions)	23	Total registrants across 3 workshops
Teaching 2.0: Introducing New Tools to Support Blended Teaching and Learning	23	Intro to the tools and pedagogy
Odette Symposium on Online and Blended Learning	36	
Total Workshop Registrants	**119**	
Situated workshops/meetings		
Faculty of Science Academic Council	12	Setting policy and academic direction in FOS
Department of Kinesiology	12	Heavy clicker users
Economics	5	New to the delivery mode
Faculty of Engineering	15	Focus on 1st year and large classes; heavy clicker users
Total Situated Workshop Participants	**44**	
Consultations		
Approximately 400 hrs of one on one consultations	Approx. 50	Several team members providing consultation across the disciplines
	Approx. 50	
Conferences		
Presentation at UWindsor Campus Technology Day (CTD) 2014	27	Internal conference open to the public
Presentation at Ontario University Council on eLearning (OUCEL) conference	25	Provincial conference
Presentation at Ontario Universities Computing Conference (OUCC) 2014	36	Provincial conference
Presentation at the Association for Authentic, Experiential, and Evidence-Based Learning (AAEEEBL) North West 2014	17	Invited international presentation
Presentation at EdMedia 2014	42	International presentation
Total Participants	**147**	

Appendix 2: University of Windsor Largest Courses by Average Class Size (all sections combined)

(Includes all on-campus and blended classes with average enrolment >100 per term since 2010)

Green = Instructor actively engaged in course redesign to include new tools from PIF project

Yellow = Instructor(s) indicated strong interest in utilising the tools and/or a partial course redesign

Course	Title	Avg. Enrolments per term offered	Current Delivery Mode
01-01-151-02	Foundations of Academic Writing II	1514	Windsor Online Course
01-01-150-01	Foundations of Academic Writing I	1503	Windsor Online Course
02-46-116-01	Introduction- Psychology/Social Science	877	Classroom
02-46-115-01	Intro. to Psychology/Behavioural Science	820	Classroom
03-60-104-30	Computer Concepts for End-Users	659	Classroom
03-64-191-01	Introduction to Astronomy II	578	Classroom
03-66-110-01	Natural Hazards and Disasters	577	Classroom
03-55-140-02	Biological Diversity	479	Classroom
03-59-141-01	General Chemistry II	478	Classroom
03-55-141-01	Cell Biology	469	Classroom
03-64-141-01	Introductory Physics II	468	Classroom
02-48-101-01	Principles and Methods of Sociology	416	Classroom
02-46-107-30	Positive Psychology	410	Classroom
06-85-118-01	Engineering and the Profession	390	Classroom
03-64-190-01	Introduction to Astronomy I	383	Classroom
02-48-102-01	Social Institutions and Social Change	379	Classroom
03-62-141-01	Integral Calculus	373	Classroom
03-59-140-01	General Chemistry I	348	Classroom
02-02-250-01	Basic Quantitative Methods	341	Classroom
04-74-131-30	Principles of Marketing	339	Classroom
03-55-211-01	Genetics	332	Classroom
06-85-120-01	Engineering Thermofluids	325	Classroom
03-66-102-30	Atmosphere and Climate	317	Classroom
03-59-230-01	Introductory Organic Chemistry	317	Classroom
11-63-375-01	Nursing Care- Complex Health Problems II	315	Classroom
03-55-213-01	Introductory Molecular Biology	289	Classroom
03-59-261-01	Organic Chemistry of Biomolecules	283	Classroom
06-92-210-01	Dynamics	279	Classroom
03-55-210-01	Ecology	276	Classroom
03-41-111-03	Introduction to Economics II	266	Classroom
02-02-250-01	Basic Quantitative Methods	264	Classroom
02-45-100-01	Intro/Canadian Government and Politics	251	Classroom
01-11-161-01	Introduction to Greek Civilization	249	Classroom
03-66-213-01	Geology and the Environment	248	Classroom

03-55-205-01	Human Physiology II	246	Classroom
06-85-222-01	Treatment of Experimental Data	246	Classroom
03-66-100-01	Introduction to Geomorphology	243	Classroom
01-11-162-01	Introduction to Roman Civilization	242	Classroom
03-66-141-01	Introduction to Environmental Science	241	Classroom
03-41-110-01	Introduction to Economics I	233	Classroom
06-91-201-01	Engineering Management and Globalization	231	Classroom
07-95-200-01	Health and Wellness	229	Classroom
07-95-265-01	Functional Anatomy	228	Classroom
07-95-211-01	Principles of Mental Skill Training	224	Classroom
07-95-280-01	Mechanics of Human Motion	222	Classroom
02-40-140-01	Introduction to Film Studies	222	Classroom
07-95-225-01	Ethics in Sport & Physical Activity	221	Classroom
02-46-116-30	Introduction- Psychology/Social Science	220	Classroom
03-64-140-01	Introductory Physics I	220	Classroom
02-49-112-30	Culture in Comparative Perspective	219	Classroom
06-85-250-01	Engineering and the Environment	212	Classroom
11-63-481-01	Transition to Professional Practice	211	Classroom
03-55-341-01	Evolution	211	Classroom
03-62-126-01	Linear Algebra (Engineering)	211	Classroom
01-07-202-30	Culture&Ideas/Black Death-Enlightenment	210	Classroom
03-55-204-01	Human Physiology I	209	Classroom
07-95-205-01	Introductory Exercise Physiology	209	Classroom
11-63-371-01	Family Nursing: Families Exper. Crisis	205	Classroom
07-95-269-01	Measurement and Evaluation	203	Classroom
07-95-250-01	Principles of Sport Management	201	Classroom
14-57-201-01	Introduction to Forensic Science	200	Classroom
02-48-260-30	Introduction to Criminology	199	Classroom
02-49-111-01	Intro to Physical Anthro and Arch	197	Classroom
07-95-270-01	Research Design	197	Classroom
02-46-220-01	Introduction to Adjustment & Personality	197	Classroom
03-62-194-01	Mathematics for Business	186	Classroom
06-85-219-01	Introduction to Engineering Materials	186	Classroom
02-43-123-01	The World in the 20th Century, 1914-1945	184	Classroom
06-85-421-01	Engineering & Society	183	Classroom
06-85-133-01	Engineering and Design	183	Classroom
05-80-205-03	Educational Foundations, Law and Ethics	181	Classroom
03-62-140-02	Differential Calculus	181	Classroom
03-66-111-01	Our Changing Earth	180	Classroom
02-46-225-30	Dev. Psychology: Adulthood and Aging	180	Classroom
03-59-235-01	Introductory Organic Chemistry II	178	Classroom

03-59-110-01	Topics in General Chemistry	178	Classroom
03-66-210-01	Introduction to Oceanography	177	Classroom
06-85-111-02	Engineering Mechanics I	176	Classroom
03-64-130-01	Introductory Physics for Life Sciences	176	Classroom
01-26-211-01	Later British Literature	173	Classroom
01-34-226-01	Law, Punishment and Morality	172	Classroom
07-95-260-01	Physiology of Fitness	170	Classroom
07-95-224-01	Introduction to Occupat.l Biomech/Ergon	169	Classroom
02-38-101-01	Introduction to Social Justice	168	Classroom
02-48-206-01	Development of Family Forms	168	Classroom
05-80-202-03	Educ.l Foundations &Instructional Design	167	Classroom
05-80-201-05	Human Dev.t & Differentiated Instruction	167	Classroom
02-46-240-30	Psychology of Sex and Gender	161	Classroom
07-95-210-01	Human Performance	159	Classroom
02-46-228-01	Abnormal Psychology	157	Classroom
06-85-119-01	Technical Communications	156	Classroom
05-80-203-01	Psychology in Education	151	Classroom
07-95-285-01	Human Growth & Development	151	Classroom
02-48-205-01	Sociology of Sexualities	151	Classroom
03-64-131-01	Introductory Physics for Life Sciences 2	148	Classroom
02-45-160-01	Introduction to International Relations	146	Classroom
03-60-141-01	Intro to Algorithms and Programming II	145	Classroom
02-43-124-01	The World in the 20th Century:1945-Pres	142	Classroom
02-46-236-01	Introduction to Social Psychology	140	Classroom
01-07-203-30	Culture&Ideas/French Revolution to Pres.	133	Classroom
01-01-120-01	Understanding the Contemporary World	129	Classroom
03-62-216-01	Differential Equations	129	Classroom
02-45-160-01	Introduction to International Relations	127	Classroom
02-46-223-30	Developmental Psychology: The Child	127	Classroom
01-34-160-91	Reasoning Skills	121	Online
03-55-100-01	Biology of Organisms	118	Classroom
02-48-262-30	Law and Social Order	115	Classroom
02-45-130-01	Comparative Politics in Changing World	110	Classroom
03-55-101-01	Organisms and the Environment	107	Classroom
02-46-224-01	Developmental Psychology: Adolescence	105	Classroom
03-62-215-01	Vector Calculus	104	Classroom
02-48-100-01	Understanding Social Life	103	Classroom
02-48-204-01	Sociology of Families	102	Classroom