



## Large TLEF Project Completion Report

Report Completion Date: (YYYY/MM/DD)

### 1. PROJECT OVERVIEW

#### 1.1. General Information

<b>Project Title:</b>	<i>Flipped Classroom Components for Math 104 and Math 184</i>		
<b>Principal Investigator:</b>	<i>Mark MacLean</i>		
<b>Project Initiation:</b>	<i>July 2013</i>	<b>Project Completion:</b>	<i>Aug 2016</i>

**1.2. Project Summary** - This project integrated flipped classroom components in two courses, Differential Calculus with Applications to Commerce and Social Sciences (Math 104 and 184) so that students could spend more time in class doing mathematics rather than observing mathematics being done. The instructors developed resources for increasing students' in-class engagement in order to improve their conceptual understanding of calculus. At the same time, the instructors designed opportunities for students to master computational skills and receive timely feedback on their work outside of class time through virtual office hours. A small-scale pilot in MATH 104 was delivered in September 2013 and the full course roll-out for MATH 104 and 184 occurred in September 2014.

**1.3. Team Members** - (Please fill in the following table and include students, undergraduate or graduate, who participated in your project).

Name	Title/Affiliation	Responsibilities/Roles
Mark MacLean	Professor of Teaching (was Senior Instructor at start), Mathematics	PI
Mahta Khosravi	Assistant Professor, Mathematics	Input in developing activities
Ed Richmond	Post-doc, Teaching & Learning Fellow	Development support in year 1
Warren Code	Assoc. Dir., Skylight	Project coordination, evaluation advising
Hailan Chen	Instructional Designer, CTLT	Instructional design with content teams
Linda Chen	Undergraduate student	Content development for student guide
Andrei Burlacu	Undergraduate student	Content development for student guide
Maxime Bergeron	Graduate Student, Mathematics	Content development for instructor guide, piloting of developed materials

**1.4. Student Impact** - Please fill in the following table with past, current and future courses that have been or will be impacted by your project, including any courses not included in your original proposal. [Note: Adapt this section to the context of your project as necessary].



Course	Section	Enrolment	Term
Math 104 (pilot activities)	102	189	2013W T1
Math 104 (pilot student guide)	108	80	2014W T1
Math 104/184 (some limited use of developed resources)		Up to ~1700 per year total	ongoing

## 2. PRODUCTS AND ACHIEVEMENTS

**2.1. Products and Achievements** - Please **update** project products and achievements as necessary. Indicate the current location of such products and provide an URL if applicable.

Product(s)/Achievement(s):	Location:
Student Guide for Math 104/184	<a href="http://blogs.ubc.ca/mathstudentguide104/">http://blogs.ubc.ca/mathstudentguide104/</a> Underlying content served from UBC Wiki based at <a href="http://wiki.ubc.ca/Documentation:Math_104_Student_Guide">http://wiki.ubc.ca/Documentation:Math_104_Student_Guide</a>
Instructor Guide for Math 104/184	<a href="http://blogs.ubc.ca/mathinstructorguide104/">http://blogs.ubc.ca/mathinstructorguide104/</a> Content stored in UBC Workspace Also a set of “Fresh Sheets” are provided to instructors each week in the term with the set of learning goals and some tips for that week of class.
Classroom activities, including clickers questions, and related items for posting on the web for outside of class.	A set of 25 class time worksheets for use throughout the term (approximately 32 class meetings total) that include clicker questions written within. Typically feature practice problems to be worked through in class. Versions of these worksheets with solutions and commentary to be made available outside of class. These incorporate some of the same ideas and are in addition to the learning goals and worksheets developed as part of CWSEI efforts in the course (see <a href="http://www.math.ubc.ca/~cwsei/math104.html">http://www.math.ubc.ca/~cwsei/math104.html</a> ) A set of 6 video worked examples (screencasts by TLF Ed Richmond) for content earlier in the course.
Online office hours: pilot with Blackboard Collaborate	N/A (see “Findings” below)

**2.2. Item(s) not Met** - Please list intended project products and achievements that were not attained and the reason(s) for this.

Item(s) Not Met:	Reason:
Overall evaluation efforts	Due to the limited roll-out of items and unanticipated demands on the schedules of personnel for reasons external to the project, a comparison with other sections and/or years in the course was not feasible.
Online office hours	Blackboard was largely unavailable in the anticipated pilot term (Fall 2013). A small pilot was later attempted, but the PI was not able to revisit this in later terms due to limited time/availability.



### 3. PROJECT EVALUATION

**3.1. Project Outcomes** - *Please list the intended outcomes or benefits of the project for students, TAs and/or instructors.*

#### **Student Guide**

A question that was not part of the original proposal but was identified as an important focus/subgoal early on: How do you coach students to be successful in the course? A student guide was developed by a pair of students who had recently taken the course in order for it to speak directly to students and give them guidance on how to succeed in Math 104. The guide consists of a UBC Blog space that pulls content from the UBC Wiki. This arrangement was chosen so that the content of the guide can be updated by anyone with a CWL; in particular, future students in the course could continue to build this up as a resource.

#### **Instructor Guide**

As there are new instructors to the course every year, and many of them have limited teaching experience, an instructor guide was developed to give some basis for them to approach the course's content, which has the additional challenge of containing business-related content that is not part of most mathematicians' training. The guide consists of a UBC Blog space that contains a series of outlines/summaries of topics accompanied by scanned lecture notes (a clear set from a particular instructor) sorted by major topic in the course. These are provided as PDF documents for two reasons: the notes can be downloaded in a portable format, and instructors can use MIT's NB annotation system to add comments overlaid on the documents, thereby turning them into conversations and to provide further insight and ideas for future instructors.

#### **Classroom Activities**

In order to boost the level of active learning in a relatively low-effort manner for instructors (especially those new to the course), classroom activities were developed to expand the existing activities developed as part of the CWSEI with this course. These are intended to promote deeper learning of concepts by students by having them engage more actively with the material during class time.

**3.2. Findings** – *Please describe the findings of your project evaluation effort: to what extent were intended project outcomes achieved or not achieved? You are encouraged to include both graphical representations of data as well as scenarios or quotes to represent key themes.*

#### **Overall**

Lessons were learned; work undertaken in this project re-emphasized the importance of resources for students and instructors (especially novice instructors) and provided some ideas around what could be effective for such support.

#### **Student Guide**

The guide was not updated during the 2015W offering of the course. The level of student usage is not clear.



### **Instructor Guide**

While the content is available in PDFs, the annotation software is clunky and significant uptake/use of this feature is not recommended; in the time since this was deployed, new annotation software has arisen (e.g., <https://hypothes.is/> and <https://perusall.com/>) but it was not in scope to update the software in this project.

### **Classroom Activities**

Some discussion with upcoming year's Instructor-In-Charge of the course about the ideas and developed items. The PI would use materials again when back teaching the course. Main finding: there is growing interest among those teaching, including those new to teaching, in being more interactive in the classroom, and there is a need to provide people with examples. There is value in having people learning about effective practices and making them their own, doing part of the work of integrating provided questions, tasks, and lesson plans.

### **Online Office Hours**

Blackboard was largely unavailable in the anticipated pilot term (Fall 2013). A small pilot was later attempted, but the PI was not able to revisit this in later terms due to limited time/availability.

### **3.3. Data Collection and Evaluation Methods - Please describe the data collection strategies used, how the data was analyzed, and perceived limitations. *Note: Please attach copies of data collection tools (e.g., surveys and interview protocols), any additional data or other relevant items.***

The scheduling issues for team members in this project significantly hampered evaluation efforts. As things did not advance enough during the Teaching & Learning Fellow's time with the project (the first year), data collection was limited: some student attitude data was collected, but there nothing clear to compare it with in a subsequent year; focus groups received too many cancellations and were not feasible at later dates.

As a result, evaluation so far has been limited:

- In development, feedback was provided regarding the online resources by the instructional designers and Cindy Underhill of CTLT.
- In deployment, limited to conversations with course leaders about their extent of introducing the new resources into the course (minimal in 2015W, which coincided with a new Instructor-In-Charge to the course; remains to be seen for 2016W).

### **3.4. Dissemination – Please provide a list of *past* and *future* scholarly activities (e.g., publications, presentations, invited talks, etc.) in which you or anyone from your team have or intend to disseminate the outcomes of this project.**

**Poster about Student Guide for FL showcase (2014) was presented \*\*\* note that this is no longer available at <http://flexible.learning.ubc.ca/news-events/fl-open-house-poster-session/>**



**4. TEACHING PRACTICES** – Please indicate if ***your*** teaching practices or those of ***others*** have changed as a result of your project. If so, in what ways? Do you see these changes as sustainable over time? Why or why not?

This project investigated some further support schemes for promoting the use of evidence-based practices among colleagues teaching calculus, with particular interest in supporting the many novice teachers (new to teaching, or at least new to UBC or to the course) in a way that is relatively low-impact on the time of the course coordinator faculty member (“Instructor In Charge”). Some steps now exist and additional lessons have been learned though a complete system was not achieved.

One issue is how one might teach to promote interactive engagement, as there are different choices. With provided examples (one of the outcomes of the project), it is generally a challenge to reuse whole but with the appropriate mindset and familiarity with key principles behind the value of interactive engagement, even relatively new instructors can make them one’s own. It is hard to teach with someone else’s materials (e.g., full lesson plans provided with textbook) and the textbook can strongly influence choices in teaching (or at least provide a particular voice which may or may not be compatible with a given person’s goals for the course). How might a project team like this “transfer” developed materials, especially given the constant turnover in the instructional team for this course, and generally involving several people quite new to teaching each year? Providing examples (as noted) is a start, and provides context for conversations with colleagues, but this must be as part of a larger support structure where such conversations can occur regularly, for example weekly team meetings for the course. All people assigned to teach are capable of giving a lecture to (mathematician) colleagues about first-year content, but how do we help them to think about the student, non-mathematician perspective, i.e. how students actually learn, not how one imagines they might learn?

In other words, materials must also come with “flexible coaching” (flexible learning for instructors): a set of interactions that promotes their growth in teaching and enculturation in the department’s teaching. For larger groups, weekly course team meetings are likely the most feasible choice. For this developed material to affect the course, we have to affect the people teaching the course and have them both trying things themselves and involved in conversations with colleagues about teaching. An Instructor-In-Charge or other experienced faculty member can be a guide in this process, though even a small team of novices with some initial coaching can grow to have significant positive changes in their teaching practice. Even experienced faculty with successful teaching strategies will try new things and improve as a result of contact with a team.

**5. PROJECT SUSTAINMENT** - Please describe the sustainment strategy for the project components. How will this be sustained and potentially expanded (e.g., over the next five years). What challenges do you foresee for achieving the expected long-term impacts listed above?

Met with new Instructor-In-Charge of the course, Shawn Desaulniers, to discuss offerings this Fall (Sept-Dec 2016). The guides will be made available for the instructors and students.

Department website is undergoing restructuring, will have much higher visibility of teaching and learning projects and their products in the near future. The CWSEI Course Materials Archive ([sei.ubc.ca](http://sei.ubc.ca)) is also undergoing a migration to a more stable, usable platform, and is anticipated as a natural home for the developed materials as they will complement the existing set from CWSEI projects in the course.



However, as there are a high number of novice instructors in this course, support them is a significant effort and the provision of these materials is only one aspect of such support. The department has continued to offer Instructional Skills Workshops within the department (though these are not taken by every new instructor to the department) that permit some time to discussed specific issues in teaching mathematics, with the topic typically being calculus.