# TLEF Project – Final Report

**Report Completion Date: (2019/03/05)**

## 1. PROJECT OVERVIEW

### 1.1. General Information

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|---|---|---|---|
| **Project Title:** | MOOC consumption: enhanced learning on campus using course material developed elsewhere | | |
| **Principal Investigator:** | Simon Bates | | |
| **Report Submitted By:** | Simon Bates | | |
| **Project Initiation Date:** | July 2016 | **Project Completion Date:** | March 2019 |
| **Project Type:** | ☒ Large Transformation<br>☐ Small Innovation<br>☐ Flexible Learning<br>☐ Other: [please specify] | | |

### 1.2. Project Focus Areas – *Please select all the areas that describe your project.*

☒ Resource development (e.g. learning materials, media)
☐ Infrastructure development (e.g. management tools, repositories, learning spaces)
☒ Pedagogies for student learning and/or engagement (e.g. active learning)
☒ Innovative assessments (e.g. two-stage exams, student peer-assessment)
☐ Teaching roles and training (e.g. teaching practice development, TA roles)
☐ Curriculum (e.g. program development/implementation, learning communities)
☐ Student experience outside the classroom (e.g. wellbeing, social inclusion)
☐ Experiential and work-integrated learning (e.g. co-op, community service learning)
☐ Indigenous-focused curricula and ways of knowing
☐ Diversity and inclusion in teaching and learning contexts
☒ Open educational resources
☐ Other: [please specify]

## 1.3. Project Summary

Originally proposed, the premise of this TLEF was to redesign and redevelop Physics 100 and 117 using a combination of an open educational resources, Colorado university MOOC videos (CU videos), and some copyrighted materials owned by publishers to improve the learning experience for students in the two courses. This approach was called an "open flip" where the focus of instruction shifts from creating content to curating already available materials and thus spending instructor time on design and delivery of classroom activities known to enhance student learning. However, for a variety of reasons including teaching duty allocations, department decision to adopt edX as the platform for Physics 100, content mismatch of CU videos for Phys 100, and delay of the University OpenStax textbook, strategies for the two courses diverged from the initial plan. It then became necessary to split the projects into two with the course coordinators as project leads. Despite the divergence, in the end all project aims and objectives were met despite the somewhat circuitous route taken.

Simon Bates led the first project, centred around Physics 117, the (then) new intro course for Physical science students that teaches introductory physics in a very different way. In the first year, we began with a publisher's text and online homework system as the content for the course, (Eric Mazur's book, conservation laws first). This choice was made at least partially because the OpenStax University Physics textbook (with calculus) was unexpectedly delayed. This initial attempt allowed us to pilot several new teaching techniques including learning logs, frequent testing, in-class worksheets, and other active learning techniques. After several iteration of developing and deploying the course, we have now achieved a streamlined version. The following year, the OpenStax University physics textbook was fully adopted and was available to students completely free.

Stefan Reinsberg and Georg Rieger led the second of these centred in Physics 100. They will use OER materials (Open Stax College Physics text, other OER content) as the basis for course materials and problems. The GRAs hired selected, classified, coded, and developed isomorphs for several hundred physics problems (most OER, but some from past midterms and final exams) inside edX – the platform used to deploy this course. Subsequent efforts included addition of adaptive hints for feedback and evaluation of use by students. One of the biggest barriers to wider adoption of open texts is the lack of online homework systems / problems that have become a mainstay of the design of large courses – in physics 100, we addressed this limitation. This version of the Physics 100 course is still in use today by over 800 students annually.

## 1.4. Team Members – *Please fill in the following table and include **students**, undergraduate and/or graduate, who participated in your project.*

| Name | Title/Affiliation | Responsibilities/Roles |
|---|---|---|
| Simon Bates | Professor of Teaching | PI |
| Firas Moosvi | Grad Student, GAA on project | Media integration (of UBoulder media files into Kaltura, and again when we moved to Canvas), course architect of Physics 117. For Phys 100, |

| | | |
|---|---|---|
| | | supervised graduate students and overall efforts to incorporate OpenStax textbook questions into the course, and developed the frequent tests in the course |
| Levi Burns | GRA on extension of project | Supervision of undergrad students working on open problem database |
| Elsa Yuan / Emma Gunn | UTA II students working on open problem library | Formatting and input of problems into open problem library |
| Pedro L.E. Fernandez | GRA | Selected, classified, coded, and developed isomorphs for several hundred physics problems for the test bank |
| Jochen (Jason) Park | GRA | Selected, classified, coded, and developed isomorphs for several hundred physics problems for the test bank |
| Scott Veale | GRA | Selected, classified, coded, and developed isomorphs for several hundred physics problems for the test bank |

**1.5. Courses Reached** – *Please fill in the following table with **past**, **current**, and **future** courses and sections (e.g. HIST 101, 002, 2017/2018, Sep) that have been/will be reached by your project, including courses not included in your original proposal (you may adapt this section to the context of your project as necessary).*

| Course | Section | Academic Year | Term (Summer/Fall/Winter) |
|---|---|---|---|
| PHYS 117 | 101 | 2016-17 | Fall |
| PHYS 117 | 101 | 2017-18 | Fall |
| PHYS 117 | 101 | 2018-19 | Fall |
| PHYS 100 | 101,102,103 | 2016-17 | Fall |
| PHYS 100 | 101,102,103 | 2017-18 | Fall |
| PHYS 100 | 101,102,103 | 2018-19 | Fall |
| PHYS 100 | 98A (B and C sometimes) | 2016-17 | Summer |
| PHYS 100 | 98A (B and C sometimes) | 2017-18 | Summer |
| PHYS 100 | 98A (B and C sometimes) | 2018-19 | Summer |

## 2. OUTPUTS AND/OR PRODUCTS

**2.1.** *Please **list** project outputs and/or products (e.g. resources, infrastructure, new courses/programs). Indicate the current location of such products and provide a URL if applicable.*

| Product(s)/Achievement(s): | Location: |
|---|---|
| Colorado U MOOC videos in Kaltura and embedded in each iteration of Physics 117 | Embedded inside Phys 117 Canvas course |
| Open Problem Library of lecture, test and exam questions | http://open-problemlibrary.sites.olt.ubc.ca/ |
| Physics 100 Test bank – 200-225 ismorphic questions | Embedded inside Phys 100 edx course |
| Scripts and code to create edX course content/modules from openStax HTML textbook | N/A |
| Introductory Phys 100 course on edX | Embedded inside Phys 100 edx course |
| Publication by Christina, Stefan, and Georg | IRRODL |
| | |

**2.2. Item(s) Not Met** – *Please list intended project outputs and/or products that were not attained and the reason(s) for this.*

| Item(s) Not Met: | Reason: |
|---|---|
| Adoption of CU videos in Physics 100 | The videos assumed knowledge of calculus so the level was not appropriate for Physics 100. |
| | |
| | |

## 3. PROJECT IMPACT

**3.1. Project Impact Areas** – *Please select all the areas where your project made an impact.*

☒ Student learning and knowledge
☒ Student engagement and attitudes
☒ Instructional team teaching practice and satisfaction
☐ Student wellbeing, social inclusion
☐ Awareness and capacity around strategic areas (indigenous, equity and diversity)
☐ Unit operations and processes
☐ Other: [please specify]

**3.2. What were you hoping to change or where were you hoping to see an impact with this project?** *– Please describe the intended benefits of the project for students, TAs, instructors and/or community members.*

Adoption of the Open Stax University Physics (Calculus-based) textbook for Physics 117 and Open Stax College Physics (Algebra-based) for Physics 100. Incorporating the MOOC videos in Phys 117 provide a suite of video lectures for students to use in a variety of ways: for additional review of

concepts; for additional practice (of embedded clicker questions); as a 'catch-up' resource if they missed lectures. In Physics 100, we created new homework assignments and test bank questions all based on OER.

We extended the project to widen the scope to build an open problem library for Phys 117, that was in principle extendable to other courses, and to populate it with several hundred original problems from the last few years of teaching the course. The extension of the project to create and populate a library of open problems assists the teaching team with being able to prepare tests and assessments from a home-grown bank of questions (the course pedagogy is built around frequent low-stakes testing of students on a weekly / two-weekly cycle). In addition, it also serves as a repository of open-licensed problems that we will seek to publish externally in due course. With these two resources implemented, the content and the majority of the assessment materials for Physics 117 are open licensed.

**3.3. Were these changes/impacts achieved? How do you know they occurred?** – *What evaluation strategies were used? How was data collected and analyzed? You are encouraged to include copies of data collection tools (e.g. surveys and interview protocols) as well as graphical representations of data and/or scenarios or quotes to represent and illustrate key themes.*

In Physics 117, we collected data on student feedback as a routine part of course enhancement. A small number of students state that they find the textbook contains 'too much reading each week' and 'it is not clear what we should be focusing on in the weekly reading' (the answer to this is 'all of the assigned chapter, unless otherwise stated'). An equal number of students appreciated the fact that the textbook was free in the course and contrasted this with other courses they were taking. These changes sit within a number of other course improvement strategies, so it is not possible to disentangle the individual positive effects of any one change.

Since Physics 100 is a large-enrollment course, each year over 900 students save on average $100 on textbook costs because the course now uses OER. This project was profiled by the Faculty of Science, and across the university as a model of how faculty members can push for open educational resources: https://science.ubc.ca/news/physics-course-adopts-open-textbook-saves-students-90000-1

**3.4. Dissemination** – *Please provide a list of **past** and **upcoming** scholarly activities (e.g. publications, presentations, invited talks, etc.) in which you or anyone from your team have shared information regarding this project.*

**Publications (spin-off):**

*C. Hendricks, S. Reinsberg, and G. Rieger, "The adoption of an open textbook in a large physics course: An analysis of cost, outcomes, use, and perceptions" The International Review of Research in Open and Distributed Learning (IRRODL) 18 (4), 78 - 99 (2017).*

*Link to paper*

**Invited Talks:**

Stefan Reinsberg and Georg Rieger were invited to present the PHYS 100 edX design at LINC 2016 in the MOOC-makers workshop at MIT (https://linc2016.mit.edu/program/workshops/mooc-makers-workshop/).

Stefan Reinsberg and Georg Rieger were also invited to present at the Hybrid Ed workshop at EMOOCs 2017 (http://educate.gast.it.uc3m.es/hybrided2017/). This was an invited talk and a contributed paper (grey literature) that is available on EMOOCs web site (http://educate.gast.it.uc3m.es/wp-content/uploads/2017/02/HybridEd_2017_paper_11.pdf).

We also presented locally at the CTLT UBC edX workshop in January 2016 (http://events.ctlt.ubc.ca/events/engaging-students-in-open-education/).

Media:

UBC Science: https://science.ubc.ca/news/physics-course-adopts-open-textbook-saves-students-90000-1

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?*

Frequent tests have been adopted by all instructors that have taught Physics 100 and Physics 117 since this project started. It is hoped that the inertia (if not the pedagogical value of frequent tests) will lead to this continuing in the future.

In terms of sustainability, the question banks require a small amount of effort each year to add in new problems and to classify them with appropriate keywords. This is probably less than 3 minutes per question (as it is effectively a cut and paste of native LaTeX source and uploading images), so takes on average only a couple of hours effort per year to maintain it up to date with all questions in.

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?*

In Physics 100, the testbank and use of edx will continue for the foreseeable future. The course is in a steady-state and we expect future faculty members to continue adding questions to the bank and improving the content in the course.

Similarly, Physics 117 runs as a well-oiled machine with homework problems on expertTA using OER, tutorial tests, lecture slides, pencasts already done. Minor tweaks and restructuring is done annually to keep the course fresh.