TLEF Small Project – Proposal Form

Created: 11/09/2015
Last updated: 11/10/2015

Page 1

TLEF Small Project - Proposal Form

All proposals must be submitted by 3:00 pm on November 13, 2015

*• Before proceeding, please read all TLEF criteria and application instructions at: **http://tlef.ubc.ca***
• Applications should be written in language understandable to a non-specialist.
• Note: the TLEF online application system is plain text. You will not be able to add tables, graphs, or charts in your proposal.
*• Click **"Save & Continue Editing"** to save your work before logging out.*
*• Click **"Save & Exit"** only when all questions are completed (you will submit at a later step).*
• Important: Your Department Head, School Director, or equivalent must indicate support for the proposal through the TLEF online application system before you can submit your proposal.

Project Title (200 characters max.)

Do not use all-caps.

Animated worked examples in online homework.

Principal Applicant

For administrative purposes, there must be one Principal Applicant only and she/he should be a full-time UBC faculty or staff member. Students may also apply if at least one full-time faculty member is on the project team and listed as a co-applicant on the project.

Principal Applicant's name	Georg Rieger
Principal Applicant's title(s) (e.g. Assistant Professor, Instructor, Professor of Teaching, etc.):	Instructor 1
Principal Applicant's primary (UBC) email address:	rieger@phas.ubc.ca
Principal Applicant's role:	Faculty
Principal Applicant's Faculty, College, or administrative unit:	Faculty of Science
If you selected Other above, please specify:	(No response)
Principal Applicant's Department, School, or unit:	Physics & Astronomy

Other Applicants

Please indicate all other applicants' name as well as corresponding title(s), affiliation(s), and email, separated by commas (e.g. Jane Doe, Associate Professor, History, Faculty of Arts, jane.doe@ubc.ca).

Stefan Reinsberg, Assistant Professor, Physics & Astronomy, Faculty of Science, reinsberg@phas.ubc.ca

Mayra Tovar, Lecturer, Physics & Astronomy, Faculty of Science, mtovar@phas.ubc.ca

Department Head & Email Address

The Principal Applicant's Department Head, School Director, or equivalent must indicate support for the TLEF proposal using the online application system before the applicant can submit the proposal. If the TLEF proposal involves multiple departments, the Department Heads of all departments where there are funding commitments made by the department must also indicate their support for the project.

Please provide the name, department/school/unit, and primary email address of the Department Head or Heads that will need to indicate their support for this project.The emails provided will be used to invite each Head to review and approve the proposal in the TLEF online application system.

Applicants are responsible for contacting their respective Department Head and ensuring that she/he is prepared to review and support the proposal through the TLEF online application system. To ensure that Department Heads have reasonable time to review your proposal, you should seek their support well in advance of the deadline for submission.

*Once the Principal Applicant's Department Head has indicated support for the proposal through the TLEF online application system, the Principal Applicant will be able to complete the final submission (**no later than 3:00 pm on November 13, 2015).***

	Name	Department/School/Unit	Primary (UBC) Email
Person 1	Colin Gay	Physics & Astronomy	head@phas.ubc.ca
Person 2			
Person 3			
Person 4			
Person 5			
Person 6			
Person 7			
Person 8			

Project Budget

Please Note: The Central funding cap for the entire duration of the project is $50,000.
This project is (please select one of the options):

New Small TLEF Project

Funding being requested from TLEF in 2016/2017:	14232
Indicate any funding from other sources being applied to this project:	8640

If this is a request for a NEW TLEF project, please provide the following information:

Future TLEF requests are anticipated for this project

Future TLEF requests anticipated for this project:

	Fiscal Year (i.e. 2017/2018; 2018/2019)	Dollar Amount
	2017/2018	14,000

	2018/2019	10,000

If this is a request for CONTINUED funding, please provide the following information:

Title of previous funded project:

(No response)

Historical TLEF funding for the project:

	Fiscal Year (i.e. 2014/2015; 2015/2016)	Dollar Amount

Future TLEF requests anticipated for this project:

	Fiscal Year (i.e. 2017/2018; 2018/2019)	Dollar Amount

If applicable, please list any other existing TLEF-funded projects currently held by the Principal Applicant:

(No response)

Project Summary (150 words max.)

Describe your project in a manner that is accessible to wide readership. If your proposal is successful, this summary may be publicized on the UBC website.

The completion of weekly homework sets is common practice in most undergraduate physics courses, especially in first year courses. The homework sets give students the necessary practice with the newly learned content and skills. In large courses, the homework is usually delivered online with automated grading that provides immediate feedback after submission.
A recent paper by Gladding et al.* suggests a new approach that has the potential to significantly enhance student learning from online homework. After submission, students can view the full solution to the problem questions in form of animated worked examples before moving on to the next level (or trying a different problem set at the same level).
We believe that this strategy would work well for the online homework of our Physics 100 course and propose adding animated worked examples to the difficult problems in the homework sets. The edX platform used in Physics 100 is well suited to implement this strategy.

* PRST - PER 11, 010114 (2015)

Students Impacted by the Project

How many students do you estimate will be impacted by this project annually? (Please provide a number)

900

Project Objectives (500 words max.)

Clearly state the project's rationale and overall objectives, with particular reference to how it meets TLEF criteria.

The main objective of this project is the enhancement of student learning from homework. Increased learning from worked examples is well supported in the literature (see for example, A. Renkl "The Worked Examples Principle in Multimedia Learning" in The Cambridge Handbook of Multimedia Learning, ed. By R. Mayer, 2nd ed. 2014). However, as Renkl points out, it is not sufficient to show one worked example – students need to engage with a few worked examples that also add learning tasks such as self-explanation. Based on this principle we believe that the online homework is an ideal environment for putting worked examples. It can lead to a synergy effect: the homework prepares the students for learning from the worked examples, which in turn provide timely, relevant feedback. Self-explanation tasks will complete the learning cycle.

A second objective is to increase the students' appreciation for the homework and make it more attainable and useful for all students. The difficulty level of homework needs to be high enough that it prepares students for examinations. An average student will therefore need help with some of the questions from either peers, instructors, or from online resources. Most online homework platforms provide hints, but do not show full solutions because instructors usually assign marks for the correct answer. (This is not the case in Phys 100. See 'Outcomes'.) Some web pages show the mathematical steps, but do not provide much explanation, reinforcing the misconception of many students that "you just have to find the right formula". By contrast, providing students with relevant animated worked examples will
- offer the opportunity to demonstrate and model expert thinking and problem-solving skills
- offer explanations at the level of the Phys 100 student population
- save students time by eliminating the search for relevant examples or solutions

A third objective is to give young undergraduate students the opportunity to work on a physics education project. We plan to engage (former) Phys 100 students with a variety of Physics knowledge as work-learn students. The students will work in small groups. The groups will script and produce the worked examples in form of desktop-style videos under our supervision. This will have the following benefits:
- explanations will be at an appropriate level for our target audience
- the participants' knowledge of physics will increase
- first or second-year students will have a rare opportunity to get a work-learn job.

Project Work Plan, Timeline & Milestones (1000 words max.)

Provide a clear work plan for how you will achieve the stated objectives of the project. Please include major milestones to indicate when you will initiate project development, when you will implement the project with students, and when you will conduct evaluation.

Jan. 2016 Write proposal for UBC's work-learn program and submit it.
April 2016 Recruit students for the project. (Nine students. Three groups of three students.)
May 2016 Aug 2016 Produce worked examples. (Three per week for 12 weeks, so 36.)
Sept. 2016 Implement examples into edX online homework sets (1 grad student TA; half unit)
Dec. 2016 Administer student survey. Look at performance on exam questions related to worked examples and compare to past exams.
Jan. 2017 Evaluate the data and write a final report.

Expected Project Outcomes (500 words max.)

List or describe the project's intended tangible outcomes or deliverables. What will the project do or create as a result of implementation of its work plan?

The project will create 36 animated worked examples that will be added to the existing Physics 100 online homework sets and linked to relevant homework questions.

Learning from worked examples is a robust effect. We expect better student performance on related test and exam questions.
The project will show whether or not the involvement of younger undergraduate students is effective, both in terms of productivity and quality of work. We believe that choosing students with a similar level of content knowledge as our target audience will yield worked examples that are at the right level in terms of language and explanations.

If the project is successful, we will seek further funding next year. In the second year of funding, we will produce
- more worked examples
- partially scaffolded homework questions as part of a “fading –guidance” strategy.

The latter is known as completion-strategy principle and is for example described by van Maerrienboer and Kester in R. Mayer, “The Cambridge Handbook of Multimedia Learning”. One example of a partially scaffolded question is providing a partial solution that students need to complete. The completion-strategy principle starts with a worked example and then fades the guidance of learners in subsequent tasks. The worked examples created in the first funding year provide therefore a good basis we can build these tasks on.

Further activities using the fading-guidance strategy can be designed to help struggling students with known difficulties. One could envision working with experienced graduate student tutors and students to provide input into the design of these relatively complex sequences. The ‘fading-guidance’ strategy could be piloted in year two of funding, but we may need another year of funding for the full implementation.

Project Benefits (500 words max.)

Referring to the project’s objectives and expected outcomes, what are the direct and short-term as well as sustainable benefits to students? Explain how these will contribute toward the enhancement of teaching and learning.

As the worked examples demonstrate correct, expert-like problem solving, we expect an improvement in problem-solving skills. Many students do not systematically use representations such as diagrams, graphs, or pictures when solving problems. The worked examples will consistently emphasize the use of these tools. We hope that students will over time adopt a systematic use of representations and become better problem-solvers.

Adding worked examples to the homework will save students valuable time. They don’t need to search for answers to homework questions or explanations. Relevant worked examples will be directly linked to difficult homework problem questions. The worked examples will also be a valuable tool for exam preparation.

The edX platform used in Physics 100 for content and homework delivery is very flexible. The worked examples can be linked from different locations, made available at certain times, combined to support help sessions, or even used in pre-class reading assignments. There are no marks in Physics 100 for homework, which is ideal for deliberately adding scaffolding. By providing the solutions in form of worked examples, we will prevent students from just looking up the answer on a “helpful” web page. When they look at our worked examples they will see the final answer, but also all the steps that lead to the answer with detailed explanations.

Finally, the work-learn students will greatly benefit from the project. They will deepen their physics knowledge from engaging with this activity and practice their team skills (see ‘student involvement’).
The project gives young undergraduate students a chance to get a work-learn job and to gain experience in project work.

Evaluation Plan (500 words max.)

Describe your evaluation strategy or process and outline any key indicators that will be used to determine the project’s success/performance. What outcome-based criteria will be used to measure success? What data will you collect to evaluate the

project's impact, and how will you collect this data?

We believe that the project will enhance students' learning from homework. A direct way of measuring this is a comparison of students' performance on examination questions to that in previous years. Many of our exam questions are unpublished, so these will be used again and/or isomorphic questions will be created. In particular the outcome of the biweekly tests in Physics 100 will be compared since the study time is limited and students will mostly study by reviewing homework and the in-class worksheets.

In addition, a survey will be created that will ask for the students' opinion about the embedded worked examples. We will also look at the number of hits on worked examples and track them as a function of time. We expect students to use this tool before the biweekly tests. Notice that Physics 100 does not have marks or due dates for the homework sets. The sets are framed as preparation for the biweekly tests.

Student Involvement (250 words max.)

Describe how students were consulted and involved in preparing/reviewing this proposal and how they will be involved in the implementation of the project.

Students were not involved in preparing this proposal.

The scripting and production of the worked examples will involve nine undergraduate students with different physics knowledge levels working in three small groups (3 students). All groups will present their products to each other and the supervisors in a session. Tips and best practice approaches will be discussed. We hope that this ensures appropriate level of explanations and language. The sessions will also give students a chance to practice their team skills and presentation skills.

Special Classroom or Facilities Requirements (150 words max.)

Does the implementation of your project require any special classroom/facilities or scheduling support (i.e. video-conferencing, lecture capture, flexible classroom space, etc.)?

We plan to make use of CTLT's Lightboard tool.