TLEF Project – Final Report

Report Completion Date: (2021/04/01)

1. PROJECT OVERVIEW

1.1. General Information

Project Title:	Developing curricular and pedagogical tools for introductory quantum computing graduate courses		
Principal Investigator:	Marcello Pavan, Olivia Di Matteo		
Report Submitted By:	Marcello Pavan		
Project Initiation Date:	March 2020	**Project Completion Date:**	October 2020
Project Type:	☐ Large Transformation ☒ Small Innovation ☐ Flexible Learning ☐ 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. Final Project Summary

This project was lead by Dr. Olivia Di Matteo, who was a quantum computing scientist at TRIUMF. In concert with the CTLT, Olivia developed the framework for a quantum computing (QC) graduate course to be taught at either PHAS, or ECE, or both. The TLEF grant supported a few graduate students in QC and machine learning (ML) who helped Olivia create the course content.

Sadly, Olivia left TRIUMF for private industry in the fall and the course development was not fully completed. Nevertheless, Olivia reported in late October 2020 that "*The students I worked with were excellent, material was put together for at least the first 3-4 weeks of content, and some more for later weeks. The course, lectures, and project were all outlined as well. … I gave access to all the materials to [Joe Salfi] (and other CREATE faculty, it's there for everyone), and I believe him and his TA were using some of it for EECE 571S this term.*" Joe Salfi indicated that "*The content is good and we are using part of it for my course [EECE 571S] but I think it could be used in a future QC applications course if we have an instructor to teach that."*

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
Rafael Haenel	PhD student in UBC PHAS	Course content contributor
David Wakeham	pPhD student in UBC PHAS	Course content contributor
Pedro Lopes	Project Manager SBQMI	

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)
EECE 571S	Joe Salfi	2020	Fall
EECE Cornerstones seminar series		2020	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:
Course content for new quantum computing course	The materials have been given to the Quantum Computing CREATE program at EECE

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:
About half the course content was not created	The lead person on the project left for private industry in the fall. Also, creating the content took longer than originally envisioned and funds ran out.

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.*

The intent was to kick-start the development of quantum computing course at UBC where none existed before in this field, which at the moment is very "sexy" and a topic of considerable interest.

3.3. Were these changes/impacts achieved? How do you know they occurred? – *How did you measure changes/impacts? (e.g. collected survey data, conducted focus groups/interviews, learning analytics, etc.) Describe what was learned from this process. 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.*

For the most past, yes, we achieved much of what we set out to do. Despite the lead investigator leaving mid project for industry, they did manage to get the framework (syllabus, lectures, term project) of the course developed, and the introductory content for the first half or so of the course completed. This was used already in EECE 571S, and will be employed by the Quantum Computing NSERC CREATE program lead by Lukas Chrostowski. In my opinion it was the kick start that quantum computing needed.

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. Be sure to include author names, presentation title, date, and presentation forum (e.g., journal, conference name, event).*

None were planned for this project.

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 dealt with developing brand new course content for a very new field, and did not consider pedagogical methods. That said, the lead investigator, Oliva Di Matteo did work closely with the CTLT in developing the course outline, so modern pedagogical techniques were embedded in the project.

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?*

The course materials have been handed over to the QC CREATE team, who will be deploying them in the courses being planned for that program, including a summer 2021 summer school. They will be put to good use!