

## Small TLEF Project – Final Report

Report Completion Date: (2019/08/31)

### 1. PROJECT OVERVIEW

#### 1.1. General Information

<b>Project Title:</b>	Expanding Pedagogical Opportunities of 3D Learning in UBC Teacher Education		
<b>Principal Investigator:</b>	Dr. Marina Milner-Bolotin		
<b>Report Submitted By:</b>	Dr. Marina Milner-Bolotin		
<b>Project Initiation Date:</b>	April 2018	<b>Project Completion Date:</b>	August, 2019

#### 1.2. Project Summary

This has been a very exciting project. We are confident that it will have a long-term impact on elementary and secondary UBC teacher-candidates in sciences and in other fields. Our goal was to explore available modern Virtual Reality (VR) and Augmented Reality (AR) Technologies, as well as available on campus 3D resources. We wanted to develop pedagogical materials linked to the new BC Science Curriculum that will promote the use of these resources in UBC Teacher Education (700+ undergraduate students annually). In addition, we aimed at exploring how other UBC students can benefit from these materials – for example, UBC science or arts students. Many of these technologies are available to UBC students for free (e.g., the OmniGlobe in the Pacific Museum of Earth <https://pme.ubc.ca/>). Yet UBC teacher-candidates have little experience with the educational implications of these tools, so very few teacher-candidates used to use these tools in their teaching during the practicum or in UBC courses offered on campus. In addition, UBC instructors who teach in the UBC Teacher Education program were also unfamiliar with many of these resources. Thanks to the support of the TLEF support we were able to change the situation!

In addition, in this project we wanted to bridge between the Faculties. For example, the Pacific Museum of Earth (<https://pme.ubc.ca/>) is located just beside the Faculty of Education, and yet, prior to our project, teacher-candidates were not exposed to the resources in the museum. Moreover, most teacher-candidates and education instructors were not familiar with the exhibits and the OmniGlobe. The OmniGlobe is one of the unique exhibits of the museum that has a significant but underutilized educational potential. These are modern resources that combine AR, VR, and hands-on exhibits to promote science and social studies learning.

Based on the feedback from the UBC teacher-candidates, on the increased number of related projects by teacher-candidates and on the growing use of 3D, VR and AR resources in teacher education, we believe that we were able to achieve our goal.

#### 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
Dr. Marina Milner-Bolotin	Associate Professor, EDCP	PI
Sharon Hu	Educational Technology Specialist, UBC Faculty of Education	Collaborator

Gerald Tembrevilla	Graduate Education Student	Graduate RA
Ryan Lin	Undergraduate Science student	Undergraduate RA
Jenny Zhu	Undergraduate Science student	Undergraduate RA
Vishnu Vinkatesh	Undergraduate Science student	Undergraduate RA
Daniel Gowryluk	Education & Outreach Coordinator & Assistant Curator	Collaborator
Dr. Kirsten Hodge	Director, Pacific Museum of Earth	Collaborator
Yvonne Dawydiak	Faculty of Education Instructor and Educational Technology Expert	Collaborator
Fred Brown	Technical Support Staff Department of Curriculum and Pedagogy	Supported the technical side of the project

**1.4. 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)
EDCP 352	301/302/303	2018-2019	Fall
EDCP 357	032	2018-2019	Fall
EDUC 450/451	All secondary sections	2018-2019	Fall-Winter
EDUC 319	Secondary science teacher-candidates	2019-2020	Fall

It is important to emphasize that all future teacher-candidates (both elementary and secondary) are invited to explore the materials created in this grant. All the materials are shared on our web site that was created specifically for this project (<http://blogs.ubc.ca/mmilner/outreach/virtual-and-augmented-reality-resources-4-stem-teachers/>). In addition, we have shared the materials during the UBC Faculty of Education TEC Expo, UBC Faculty of Education Technology Sandbox, as well as during the annual UBC Faculty of Education Family Mathematics day that is run by about 100 teacher-candidates and has more than 400 guests: <http://blogs.ubc.ca/mmilner/outreach/family-math-science-day-at-ubc-faculty-of-education/>. Moreover, the resources will be featured on the website of the Pacific Museum of Earth <https://pme.ubc.ca/connect/> such as they will be open to all the science students, as well as the general public. In addition, the resources we have created will be used by the students in the Faculty of Science, as the resources will be linked to the Pacific Museum of Earth. Finally, all UBC students, faculty and visitors have free access to these resources.

## 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:
Educational materials for the use of the OmniGlobe:	<a href="https://blogs.ubc.ca/virtualreality/omni-globe-resources/">https://blogs.ubc.ca/virtualreality/omni-globe-resources/</a> <a href="https://pme.ubc.ca/exhibitions/omniglobe/">https://pme.ubc.ca/exhibitions/omniglobe/</a>

Educational materials – Virtual and “Real” Geology Kit and materials	<a href="https://blogs.ubc.ca/virtualreality/geology-tookit/">https://blogs.ubc.ca/virtualreality/geology-tookit/</a> and <a href="https://www.youtube.com/watch?v=Q2MdzT2EIIY&amp;t=238s">https://www.youtube.com/watch?v=Q2MdzT2EIIY&amp;t=238s</a>
VR and AR materials for K-12 educators (for UBC teacher-candidates)	<a href="https://blogs.ubc.ca/virtualreality/vr-ar-resources/">https://blogs.ubc.ca/virtualreality/vr-ar-resources/</a>
Virtual tours – through Google Tours support	<a href="https://www.youtube.com/watch?v=umCxThmfemk&amp;t=261s">https://www.youtube.com/watch?v=umCxThmfemk&amp;t=261s</a>

**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:
Materials for VR and AR related to coding	We have achieved more than what we had expected. However, we also realized that new BC curriculum for K-12 places a lot of emphasis on coding, engineering, and placed-based learning. We want to focus on that. We will do it even our project is formally over. We have students who will be working on these materials as their M.Ed. and M.A. projects.

**3. PROJECT IMPACT**

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

Our goal was to create a resource of science and mathematics experiments that reflects both new BC Science Curriculum and novel educational technologies, such as VR, AR and 3D resources to help future teachers learn how to engage their students in inquiry learning. We wanted to help them build skills and confidence in communicating science to K-12 students and the general audience using novel technologies that students already use in their lives beyond the classroom (VR and AR). We also wanted to motivate teacher-candidates to learn how to use video editing software, such as Camtasia (available to ALL UBC students and faculty for free) and to design their own educational resources. We continued to populate our Video Database that started with our previous TLEF project. So there is continuity from project to project: [https://www.youtube.com/channel/UCHKp2Hd2k\\_dLjODXydn2-OA/videos](https://www.youtube.com/channel/UCHKp2Hd2k_dLjODXydn2-OA/videos) We added more than 10 new videos to the database in this project.

Thanks to this TLEF support, our science methods courses have changed their syllabi. We have introduced these resources to teacher-candidates via workshops that were led by the students who contributed to the project (Ryan and Jenny). These resources will be implemented in the assignments in science methods courses this year. The fact that our students use this resource continuously as part of their course assignments and the preparation for the Family Mathematics and Science Day (an annual STEM outreach event at the Faculty of Education) shows that it is used. The instructors successfully integrated the resource into their science methods courses. The resource will keep growing beyond the TLEF year.

The project had an unexpected impact on the graduate students in our Faculty. Our graduate students (Kwesi Yaro and Gerald Tembrevilla) are now investigating different aspects of science and mathematics outreach and how we can create effective resources to promote mathematics and science learning. In

addition, as the result of this resource being available online and widely used, we have more applications for graduate studies in our program. This is very important for us. This is now part of our research and science outreach efforts. The resources we have created make a difference in the UBC Faculty of Education community and at the UBC community at large. This would not have happened if we didn't receive this support and the support in the previous TLEF grants.

**3.2. Were these changes/impacts achieved? How do you know they occurred?** – *To what extent were intended benefits achieved or not achieved? 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.*

- 1) We have been collecting feedback from the teacher-candidates and from the instructors.
- 2) Course syllabi in the Department of Curriculum and Pedagogy have been adjusted to incorporate our resources and new assignments were introduced that use our resources.
- 3) Science Methods courses now visit Pacific Museum of Earth as part of the course syllabus.
- 4) We presented these resources during the Faculty of Education TEC Expo.
- 5) We will also be measuring how Teacher-Candidates are using these hands-on experiments during their long practicum – February-April, 2020.

**3.3. 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.*

- 1) As mentioned above, we have graduate students working on these projects now. We hope to have a number of publications as a result. So far, we have two publications:
  - a. G. Tembrevilla and M. Milner-Bolotin, Engaging physics teacher-candidates in the production of science demonstration videos. *Physics Education*, **54**(2) (2019) 025008-025018; and we also have submitted a STEM-2020 Conference Proposal on the topic of this grant.
  - b. M. Milner-Bolotin, et al., Pushing the boundaries of science demonstrations using modern technology. *Canadian Journal of Physics*, **Accepted September 2019** (2019) 15.
- 2) We participated in the UBC Faculty of Education TEC Expo and presented these resources.
- 3) We presented the results of our project at the CAP 2019 Congress in Vancouver – Canadian Association of Physicists Congress: M. Milner-Bolotin and R. Hawkes. *Implementing innovation in physics teaching and learning*. in *Congress: Canadian Association of Physicists*. 2019. Burnaby, BC: Canadian Institute of Physics.
- 4) We also presented during the UBC Celebrate Learning Week 2019: M. Milner-Bolotin, et al., *Expanding pedagogical opportunities for 3D learning in teacher education*, in *UBC Celebrate Learning Week*. 2019, UBC Centre for Teaching Learning and Technology: UBC.

**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?*

*We described it above. Yes, it had a direct impact on our teaching practices.*



- 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 project modeled how to create educational resources that address the challenges of the new curriculum and incorporate modern VR, AR and 3D resources, and now it became a part of our courses. From now on, our teacher-candidates will be using this resource and contributing to its growth.