

Final Report – maximum 2 pages and PG Financial Report Extract

Project Name: Turning Teacher-Candidates to Inquiry: Improving Preparation of Future K-12 Teachers in Mathematics and Science through Active Technology Engagement (Year 3)

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Summary of Accomplished Work

I am proud and honored to write a report on the final (3rd) year of our TLEF-funded project. I have received a number of TLEF grants in the past and I can attest that this grant has had the largest impact we have ever experienced (we have ample research data to support this claim). The goal of the grant was to create and implement research-based educational resources in the context of K-12 math and science (M&S) teaching and learning that can be used in UBC Teacher Education Program in order to help bring technology-enhanced inquiry into practice. The third year of the project combined the design and implementation of these resources expanding to the use of probeware (such as Vernier). We also had an opportunity to see how the engagement with the resource impacted the first years of teaching of our teacher-candidates. Our philosophy is that teacher education should bridge educational research with educational practice, and using research-based technology-enhanced pedagogies, such as Peer Instruction, PeerWise, Live data collection and analysis are great vehicles to achieve this goal. The resources we began developing in 2012 is currently being used by teacher-candidates at UBC, practicing teachers (our own graduates) and teacher educators: Math and Science Teaching & Learning through Technology <http://scienceres-edcp-educ.sites.olt.ubc.ca> . Thanks to TLEF support today it hosts more than 2000 different inquiry-driven instructional resources geared to K-12 M&S teaching and learning. Every resource is supplemented with pedagogical guidelines, solutions, extensions, explanations. This was especially important for UBC elementary and secondary teacher-candidates who participate in a 13-week practicum in local schools. While prospective M&S secondary teachers teach the subjects they have expertise in, prospective elementary teachers have to teach all subjects with having very limited expertise. It is especially detrimental for M&S education. Thus, for elementary teachers having this resource is especially valuable. It made a huge difference for teacher-candidates, as they were able to implement the interactive engagement pedagogy modeled for them during the methods classes into practice. We also used our resource as a bridge between the UBC Teacher Education and local schools, as it is a great opportunity to attract educators into our graduate programs and bring educational innovations into practice. Considering that BC is experiencing curriculum revision, this is crucial. As the resource is free and specifically geared to BC M&S curriculum, students and teachers are welcome to use it. During the second year of the project we engaged teacher-candidates in designing and evaluating of these resources through the use of PeerWise collaborative tool.

The TLEF funding helped us attract high quality undergraduate and graduate students to the project and bridge between the Faculties of Science and Education, as undergraduate students from the Faculty of Science work alongside graduate students from the Faculty of Education (this also helps encourage talented undergraduate science students who are

interested in teaching and learning, to consider a career in education through a dual science degree). While our original goal was to help infuse active engagement pedagogies into teacher education through providing conceptual clicker questions, through working with teachers and students we realized that we can do more than that. Thus, this resource was expanded to other technologies that support inquiry-based science and mathematics education, such as computer simulations, video analysis, video-resources, live data collection, etc. More than 20 undergraduate, graduate students and teacher-candidates have been working on the project so far. At the same time, these resources have been widely used with our teacher-candidates at UBC M&S teacher-education courses. The resource we created was very timely with UBC Teacher Education Program moving toward incorporating more inquiry, thus other faculty members became interested in it and started using it in their own courses. To help them, we organized professional development workshops at the Faculty of Education and invited them to observe classes where clicker-enhanced pedagogy (Peer Instruction) was used. Moreover, the initial TLEF funding helped us to get supplemental funding from MITACS and other sources to attract undergraduate computer science students to help us with the technical side of the database.

Lastly, we have participated in a number of local, provincial, national and international professional development and research events during this year, and we can attest that our resource elevates UBC teacher education program to the world-class level through active engagement of future M&S teachers in inquiry-based teaching with technology. More information about these events can be found on the project's web site.

Evaluation of Project's Success

Alongside developing the project, we are working on rigorous evaluation of its impact.

1. Milner-Bolotin, M. (2015). Promoting Deliberate Pedagogical Thinking with Technology in physics teacher education: A teacher-educator's journey. In T. G. Ryan & K. A. McLeod (Eds.), *The Physics Educator: Tacit Praxes and Untold Stories*.
2. Egersdorfer, D., Vinayagam, M., & Milner-Bolotin, M. (2015). *Using PeerWise technology to promote physics teacher-candidates' pedagogical content knowledge*. Paper presented at the 18th UBC Investigating Our Practices Conference, Vancouver, BC.
3. Milner-Bolotin, M. (2015). *Engaging students in science learning through creative technology use*. Paper presented at the Surrey Science Teachers' Association Annual Meeting, Simon Fraser University, Surrey, BC. <http://www.staconvention.ca/index.php?action=schedule&track=4>
4. Milner-Bolotin, M. (2015). Technology-enhanced teacher education for 21st century: Challenges and possibilities. In X. Ge, D. Ifenthaler & J. M. Spector (Eds.), *Emerging technologies for STEAM education* (pp. 135-153). Switzerland: Springer International Publishing.
5. Milner-Bolotin, M. (2015). Learning physics teaching through collaborative design of conceptual multiple-choice questions. *The Canadian Journal of Action Research*, 16(2), 22-41.
6. Please see our project web site for more details.