

Expanding Pedagogical Opportunities for 3D Learning in Teacher Education

Marina Milner-Bolotin¹, Sharon Hu¹, Jenny Zhu², Gerald Tembrevilla¹, Anna Mittelholz², Kirsten Hodge^{2,3}, Daniel Gowryluk^{2,3}

¹ Department of Curriculum and Pedagogy, UBC Faculty of Education, ² Faculty of Science, Pacific Museum of Earth³

UBC Teacher Education

More than 700 K-12 teacher-candidates (TCs) graduate annually from the year-long [UBC Teacher Education Program](#) – the biggest teacher education program in British Columbia. In it, TCs learn about innovative pedagogies and curricula, while experiencing novel educational technologies as learners and as teachers.

This project's goal is to expose TCs to innovative technology-enhanced pedagogies that use virtual and augmented reality (VR & AR) tools, collaborative tools, such as Google Tours, 3D Learning opportunities, and the OmniGlobe located at the UBC Pacific Museum of Earth. We have also created virtual boxes – a collection of technology-enhanced resources for science teaching.

TCs & Pedagogical Innovations

We have a history of technological innovations in teacher education, such as a 2016-2017 TLEF-funded project that engaged TCs in the design of educational videos of science experiments, which were later used during their practicum (Fig. 1).



Figure 1: Science and Math Video-Experiments database designed by science teacher-candidates.

New Curricular Challenges

The new BC science curriculum emphasizes big ideas, science connections to everyday life, promotes cross-curricular competencies while focusing on place-based learning. Students are asked to observe, measure, & record data, using appropriate tools, as well as reflect on their experiences. TCs must acquire the Technological Pedagogical Content Knowledge to address the challenges of the new curriculum. Technology can play a big role in it.

The OmniGlobe at PME

Pacific Museum of Earth (PME) is a hidden gem on the UBC campus. Despite being directly relevant to the new BC curriculum; being free and having an OmniGlobe – a 3D digital display (Fig. 2), it has yet to be widely used by our TCs.

To do that, we designed resources, such as lesson plans, conceptual questions, activities, that are directly linked to the new BC curriculum and that TCs can use during their practicum and beyond.



Figure 2: OmniGlobe at the Pacific Museum of Earth

Digital 3D Resources Toolbox

3D technology is a collection of practical and versatile tools that can enrich learning and enhance teaching. Through virtual learning environments, animations, and 3D-printed models we aim to provide a thorough and innovative learning experiences that prepare TCs' for engaging 21st century students in science.

The Digital Toolbox will include:

- Lesson plans and activities that include 360° and 3D science videos that can enable TCs to take students on virtual field trips out of the comfort of their own classrooms.
- 3D models of objects to help visualize and convey challenging concepts (Fig. 3).
- Collections of science resources relevant to BC that TCs will be able to borrow during their practicum, such as a Rock Collection (Fig. 3) with accompanying lesson plans and activities. This is especially important as so far, TCs were not able to borrow science resources from UBC for their practicum and few BC schools have these resources.



Figure 3: Rock Collection for Classrooms

Google Tours

Few TCs used digital collaborative tools, such as Google Tours (Fig. 4) as students. It is crucial that they experience these tools as TCs and learn to incorporate them into teaching.



Figure 4: Rock Collection for Classrooms

References

1. Tembrevilla, G., & Milner-Bolotin, M. (2019). Engaging physics teacher-candidates in the production of science demonstration videos. *Physics Education*, 54(2), 025008.
2. Milner-Bolotin, M. (2018). Evidence-based research in STEM teacher education: From theory to practice. *Frontiers in Education: STEM Education*, October, 14. doi:10.3389/educ.2018.00092
3. Milner-Bolotin, M. (2018). Reimagining technology-enhanced STEM teacher education for 21st century: From more technology to increased quality of teaching and learning. In J. Mason (Ed.), *Future Schools 2030* (pp. 20). Switzerland: Springer.

Acknowledgements

We acknowledge the generous support of the UBC Teaching and Learning Enhancement Fund (TLEF) and of the Pacific Museum of Earth.