TLEF Project – Final Report

Report Completion Date: (YYYY/MM/DD)

1. PROJECT OVERVIEW

1.1. General Information

Project Title:	Using 3D visualization to Teach the Critically Important Anatomical Aspects of the Pterygopalatine Fossa for the Administration of Local Anesthesia of the Mid-Face		
Principal Investigator:	Dr. PJ Murphy		
Report Submitted By:	Dr. PJ Murphy		
Project Initiation Date:	June 2022	**Project Completion Date:**	September 2025
Project Type:	☐ Large Transformation ☒ Small Innovation ☐ UDL Fellows Program ☐ Hybrid and Multi-access Course Redesign Project ☐ 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 – *What did you do/change with this project? Explain how the project contributed toward the enhancement of teaching and learning for UBC students.*

This project addressed the persistent challenge of teaching the anatomy of the pterygopalatine fossa (PPF), a small and complex anatomical space that is crucial for dental practice. Traditional resources such as 2D illustrations and cadaver dissections were insufficient for teaching its spatial relationships.

We have utilized an existing resource, the Fossa Finder, as a building block to develop our interactive 3D visualization tool. The Fossa Finder is a guided, open-access 3D model of the PPF.

Our tool, the Local Anesthesia (LA) Simulator, is a simulation tool that allows students to virtually perform maxillary local anesthesia and receive immediate feedback.

A mixed-methods evaluation was conducted with 107 Year 1 and Year 2 dental students at UBC. Students overwhelmingly reported that the tools:

- Improved their spatial visualization and understanding of complex anatomy.
- Enhanced the clinical relevance of gross anatomy.
- Supported self-paced, accessible learning as adjuncts to cadaver labs.

Survey data revealed a strong positive correlation between tool usability and the students perceived impact on anatomy learning. Content analysis identified several areas for improvement, including the navigation, browser compatibility, and additional interactivity.

Overall, the project advanced the integration of technology-enhanced anatomy learning at UBC, created sustainable open-access learning resources, and contributed evidence on their educational value.

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
Dr. Pawel Kindler	Professor of Teaching	Tool development, study design, manuscript preparation
Dr. Tala Maragha	Honorary Assistant Professor	Tool development, study design, Pilot testing, data collection, manuscript preparation
Dr. Madhurima Datta	Former PhD student at UBC	Tool development and testing
Dr. Jasper Huang	Former dental student at UBC	Tool development, study design, Pilot testing, data collection

1.5. Courses Reached – *Please fill in the following table with **past** and **current** courses (e.g., HIST 101, 2017/2018) that have been 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	Academic Year
DENT 410 FMS 1: Fundamentals of Body Design	2022/2023
DENT 410 FMS 2: Fundamentals of Medical Sciences	2022/2023

2. OUTPUTS AND/OR PRODUCTS

2.1. *Please **list** project outputs and/or products (e.g., resources, infrastructure, new courses/programs). Indicate a URL, if applicable.*

Output(s)/Product(s):	URL (if applicable):
LA Simulator: Interactive simulation of local anaesthesia in the maxillary arch	https://dxl-fossafinder.s3.ca-central-1.amazonaws.com/index.html
Embedded assessment questions aligned with Bloom's taxonomy	https://dxl-fossafinder.s3.ca-central-1.amazonaws.com/index.html

2.2. Item(s) Not Met – *Please list intended project outputs and/or products that were not completed and the reason(s) for this.*

Item(s) Not Met:	Reason:
N/A	

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-satisfaction

☒ Teaching practices

☐ Student wellbeing, social inclusion

☒ Awareness and capacity around strategic areas (Indigenous, equity and diversity)

☐ Unit operations and processes

☐ Other: [please specify]

3.2. Please provide details on each of the impact areas you selected in 3.1. – *For example, explain in which ways your teaching practices changed; how student wellbeing was impacted; how students wellbeing benefited from your project, etc.*

Students' Perceived Impact on Learning: Students reported improved understanding of the PPF and its clinical applications. Quantitative survey results confirmed statistically significant links between usability and learning outcomes.

Engagement: The 3D interactivity and embedded quizzes fostered active, self-directed learning. Students described the tools as "better than cadavers for visualizing structures" and "a resource I will revisit."

Teaching Practices: Faculty incorporated the tool into their lectures, and utilized them as adjuncts to dissections in the PPF sessions. The tools provided sustainable alternatives to limited cadaver access.

Accessibility/Equity: Open-access delivery broadened reach across student groups, reducing reliance on physical skulls or VR equipment. In fact, the resource will be piloted with other dental schools in Canada and beyond.

3.3. How do you know that the impacts listed in 3.1/3.2 occurred? – *Describe how you evaluated changes/impacts (e.g., collected survey data, conducted focus groups/interviews, learning analytics, etc.) and what was learned about your project from the evaluation. You are encouraged to include graphical representations of data and/or scenarios or quotes to represent and illustrate key themes.*

The evaluation of the students' experience with the LA Simulator was conducted via surveys that included Visual Analogue Scale (VAS) questions and open-ended questions. The results can be summarized as below:

Quantitatively: Significant correlations were identified between the tool's usability and its perceived impact on learning (Year 1: $r = 0.79$; Year 2: $r = 0.97$; $p < 0.0001$).

Qualitatively: Students highlighted the tool's strengths in enhancing their sense of spatial orientation, clinical relevance, and accessibility. Tool's limitations were mainly technical, including issues with navigation of the tool, and the need for additional support while exploring the tool for the first time.

Representative Quote: "*The fact that we can manipulate and see directly inside the fossa is an incredible strength that helps aid students in learning the content.*"

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?*

Faculty have integrated the tools, both the Fossa Finder and the LA Simulator, in teaching anatomy for dental students. These practices are sustainable as the tools are open-access, digital, and cost-free, requiring no ongoing infrastructure beyond minor updates.

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 project sustainment?*

- Tools will remain available upon request from the Principal Investigator.
- Updates (navigation improvements, additional questions) will be incorporated in future versions.
- Potential expansion to other anatomical regions has been identified as a future direction, in addition to incorporating a Virtual Reality element into the LA Simulator.
- Sustainability is strengthened by the open-access format of the tool

6. **DISSEMINATION** – *Please provide a list of 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). These will be included on the TLEF scholarly output page.*

The findings of the evaluation study have not been disseminated yet.