Faculty of Science, Department of Biology

Photogrammetry as a tool to Build 3D Virtual Resources

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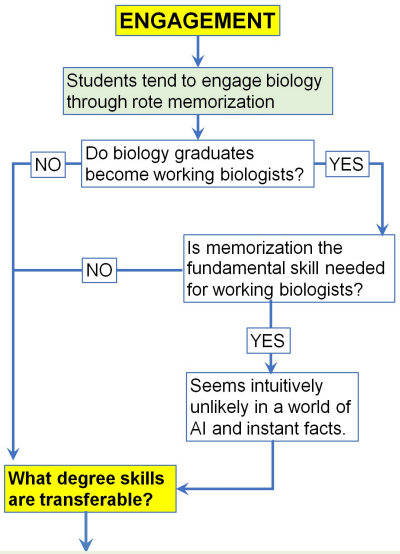
The Problem with Teaching Vertebrate Structure/Function.

- Typically relies on limited numbers of fragile specimens, and on animal dissections
- ***Harm:*** Biological specimens (e.g. skulls) are fragile & generally irreplaceable
- ***Harm:*** Dogfish (*Squalus* sharks) are a classic model organism, but are wild caught & not necessarily caught sustainably
- How do we preserve specimens and reduce harm, without losing the value of hands-on experiential learning?

Biology Majors Have Major Misconceptions.



How do we engage students to show them that they can engage with biology through conceptual understanding, critical thinking, and practical skills?

Building digital models for Multi-Modal Learning

Photographic setup, and a photogrammetry 3D reconstruction of a fragile long-nose gar skull.

Computer Science student, Rodrigo Lopez, multi-tasking; working two photographic setups for two skulls.

Laser-scanning an alligator skull for fine surface detail, which will hopefully be combined with photogrammetry to produce a high-resolution, photorealistic digital model

Can we inspire the curiosity of students…not just about biology trivia, but about conceptual understanding, critical thinking, and about the tools that make understanding biology possible?

Digitizing specimens preserves specimens & reduces *Harm*

Building high definition, photorealistic 3-D models preserves specimens by reducing wear and tear from direct interaction.


After texturing

Replacing dissections with digital tools reduces reliance on animal specimens, and reduces ethical & environmental impact

We hope to create high quality digital models of animals dissections

3D Printing *Preserves the Hands-On*…on the cheap

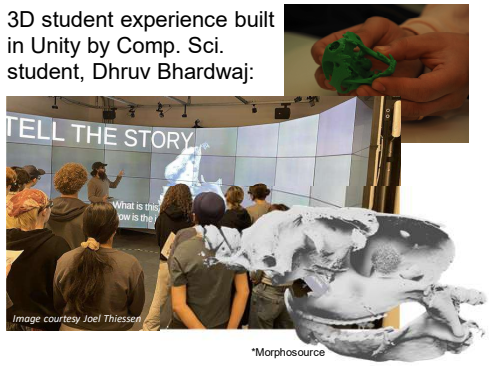
…3D printing provides relatively cheap access to replaceable models with which students can physically interact with no risk of damage

Left: Crocodile model purchased from Bone Clones, Cost: ~ $175. **Right:** Alligator, Cost: ~ < $1

Learning with the hands-on, & through the art of the story

Visualization and Emerging Media Studio:

3D student experience built in Unity by Comp. Sci. student, Dhruv Bhardwaj:



Undoing Misconceptions About Learning Biology

Excerpts From the Students…

"I learned that even if you know some material or specific details, you must articulate it well to show your knowledge appropriately. I will be working on this skill for next term because it is important when communicating to your audience"

"What I learned this course that has been the most interesting is how biology is not entirely memorization and what is important is how biology is about painting a picture of adaptations through different environments and evolutionary relationships that result in the memorizable facts that people focus on"

Through digital interactive experiences, and 3D printing, we hope to expose biology students to the realty of biology as a multidisciplinary science, and help them view their degree as an exercise in building skills, not a library of trivia.

THE UNIVERSITY OF BRITISH COLUMBIA

*3D Anatomy Studios (2022). CT scan of a spiny dogfish shark (Squalus acanthias) purchased from Carolina Biological Supply, ID 3DAS-ID00003 (published BMP files). Retrieved from MorphoSource ARK:/87602/m4/435545.

Partners CONSTELLATION

- We would like to acknowledge The Hive, for their help with photogrammetry workflows. https://hive.arts.ubc.ca/
- Thanks to ALT-2040 for making it possible to hire *Rodrigo Lopez* (3D models) & *Dhruv Bhardwaj (Virtual 3D Experience)*