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## INTRODUCTION

- Natural history collections provide numerous opportunities for authentic and hands-on learning experiences for science students<sup>1,2</sup>.
- The Beaty Biodiversity Museum (BBM) houses UBC's biological research collections and hosts over two million specimens, with over 706,000 herbarium specimens (vascular plants, bryophytes, algae, fungi).
- Most UBC Biology Program courses do not use the Museum as a teaching resource or use only the public displays. Large courses (first, second-year) rarely interact with research specimens.
- A significant barrier to using BBM specimens is the large effort required by BBM staff to coordinate activities that use physical specimens.
- The rapid increase in easily-accessible digitized specimen data<sup>3</sup> can potentially overcome this barrier while providing the same valuable learning experiences for students<sup>4</sup>.

## OBJECTIVES

- Assess first-year students' knowledge, interests and perceptions of biological diversity before and after interacting with BBM research specimens.
- Assess whether these impacts differs when students interact with specimens virtually compared to in-person.

## METHODS

- Students in an introductory biology course for science majors (BIOL 121: Genetics, Evolution, Ecology; n=190) participated in either an in-person or online version of the "Beaty BioBlitz" activity that lasted 2 hours total (Figure 1).
- For all students, the first part of the activity included a short introduction to natural history collections and collections-based research. Students then used research specimens (physical for in-person, digital for online version) to complete a worksheet about biological variation, specimen collection and preservation.
- For the second part, students at the museum contributed to an on-going inventory of the UBC Herbarium specimens, counting specimens for approx. 30 mins. Online students accessed UBC Herbarium specimens using the Consortium of Pacific Northwest Herbaria website to explore the distribution and collection records of targeted species in order to propose a future collection trip.

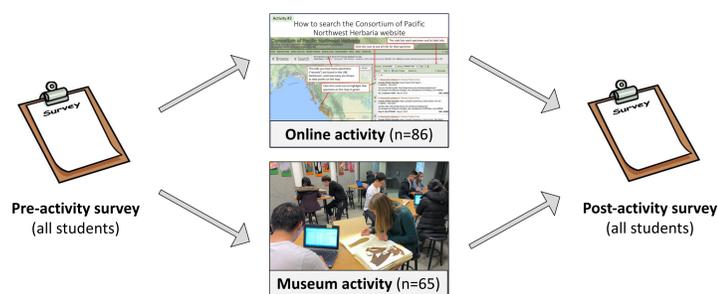


Figure 1: Flow chart of the BBM BioBlitz activity. Each student completed an online pre-activity survey, followed by either the online activity or in-person activity at the museum, and finally an online post-activity reflection survey.

## METHODS CONTINUED

- All students completed the same pre-activity survey and post-activity survey (a mix of multiple-choice and short-answer written questions).
- Short-answer responses were coded based on common response types (e.g., "making specific reference to the specimen", "commenting on specimen diversity or variation", etc.) determined by three reviewers.

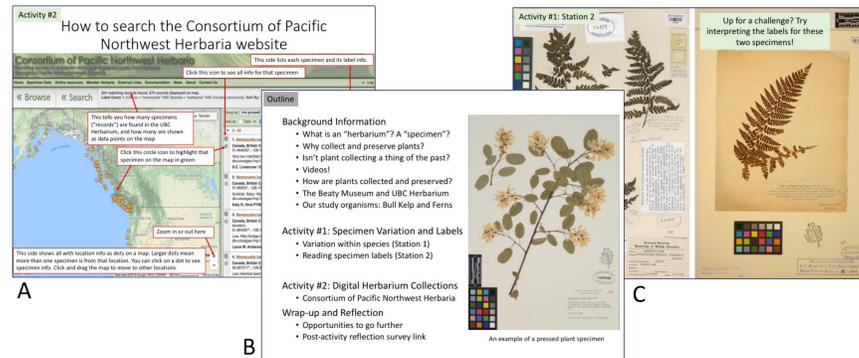


Figure 2: Example slides used for the online version of the Beaty BioBlitz activity: A) Tutorial for searching the Consortium of PNW Herbaria site, B) Introduction to the activity, C) BBM research specimens used for completing the worksheet about specimen collection and preservation.



Figure 3: Students during the in-person version of the Beaty BioBlitz activity. Photos: B. Clarkston

## RESULTS

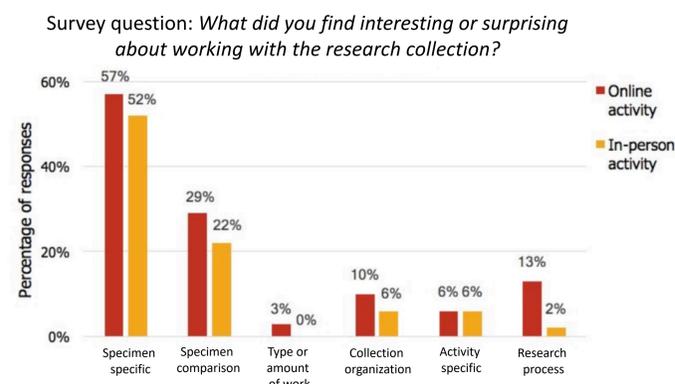


Figure 4: Student responses to the post-activity question "What did you find interesting or surprising working with the research collection" for both online (red; n=86) and in-person activity (orange; n=65)<sup>5</sup>. No significant difference for any response categories between online and in-person responses (ANOVA: F(1,149)=0.57, p=0.452).

### Sample open-ended responses to the above question:

- I didn't expect such a high number of specimens in just British Columbia [specimen-specific; online]*
- There's so much variation, even when the specimen (sic) are from the same species! [specimen comparison; online]*
- I was unaware of the fact that museums collected and preserved specimens, so I found that pretty interesting. [collection & organization; online]*

## RESULTS CONTINUED

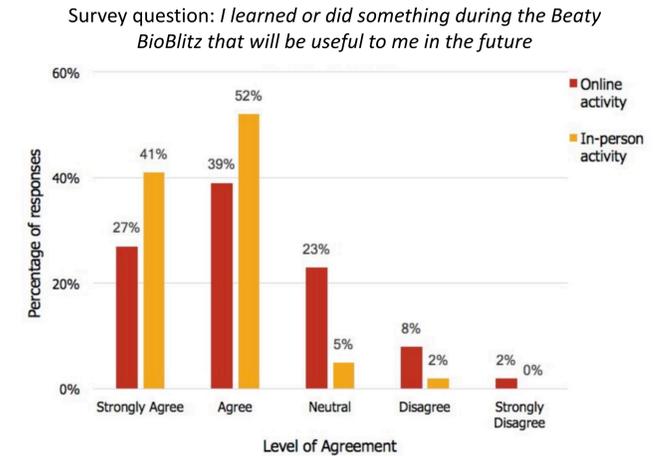


Figure 5: Student agreement to the statement "I learned or did something during the Beaty BioBlitz activity that will be useful to me in the future". There was no significant difference between online (red; n=86) and in-person (orange; n=65) responses (ANOVA: F(8)=3.200, p=0.11)<sup>5</sup>.

### Sample open-ended responses to the above question:

- Something that I learned that will be useful for me in the future is understanding the importance of proper documentation as this aspect is essential for ensuring that collections and databases are accurate. [online]*
- I learned the importance of keeping good records...I think this activity helped me in realising how important every persons work is because it adds value to a collection as a whole. [in-person]*
- This activity allow me to see the different type of seaweed that exist and many I have not even heard of. This activity gave me another reason to like biology. [online]*
- It was the first time I actually got to learn a bit more about how researchers study specimens [online]*

## CONCLUSIONS & NEXT STEPS

- Students from both the online and in-person activity were most interested in and surprised by the level of variation between specimens of the same species, the age and high-quality preservation of museum specimens, and how museum specimens are prepared and organized.
- Preliminary survey analysis suggests that students find the online and in-person activity to be similarly useful and interesting.
- Next step is to develop an online activity that allows first-year students to contribute to a museum initiative in a similarly meaningful way (e.g., transcribing specimen labels) to the in-person BioBlitz inventory.

## REFERENCES

- Cook JA, Edwards SV, Lacey EA, Guralnick RP, Soltis PS, Soltis DE, et al. Natural history collections as emerging resources for innovative education. *BioScience*. 2014; 64:725–34.
- Hiller AE, Cicero C, Albe MJ, Barclay TLW, Spencer CL, Koo MS, et al. (2017) Mutualism in museums: A model for engaging undergraduates in biodiversity science. *PLoS Biol* 15(11): e2003318. <https://doi.org/10.1371/journal.pbio.2003318>
- Soltis PS, Nelson G, James SA. Green digitization: Online botanical collections data answering real-world questions. *Applications in Plant Sciences*. 2018 Feb;6(2):e1028.
- Powers KE, Prather LA, Cook JA, Woolley J, Bart Jr HL, Monfilis AK, Sierwald P. Revolutionizing the Use of Natural History Collections in Education. *Science Education Review*. 2014;13(2):24–33.
- Czekajlo A, Gray M, and Lewko R. The Impact of Experiential, Research- and Community-Based Learning in Herbaria on First-Year University Students. 2018; cIRcle: UBC's Digital Repository: <http://hdl.handle.net/2429/65753>

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