Course-Based Undergraduate Research Experiences at the University of Washington Tacoma: Scaffolding Research Experiences

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Institutional Context

University of Washington Tacoma has a “non-traditional” and place-bound student body, with an average age just under 27 years old, over 68% first generation students, 80% transfer students, 70% on financial aid, and 10% students who receive veteran’s benefits. Currently, the only natural science offered on campus is an interdisciplinary Environmental Science major, which is fundamentally committed to the High-Impact practices of writing-intensive courses, collaborative projects, community-based learning, internships, capstone courses and projects, and most notably, the incorporation of undergraduate research at all levels of our curriculum.

CUREs Scaffolded Across the Curriculum, Emphasizing Steps of Scientific Method

- Observation
- Data collection
- Experimental design
- Hypothesis development
- Data analysis and hypothesis testing

In this upper-division elective course, students fully develop their data collection skills by implementing a Department of Ecology (DOE)-inspired monitoring program of biodiversity in Commencement Bay. They study the existing DOE report, meet the scientists who work on the project, learn some basic invertebrate zoology (“just in time”), sample new sites from a boat, quantify animals in their samples (with different groups of students becoming “experts” in various taxa), do a range of biodiversity calculations, and work together to create a single large report for submission to DOE and a local non-profit whose mission is the conservation of Commencement Bay. A number of class alumni have become interns with Ecology as a result of taking this class, and one is currently employed there.

Literature Cited


Forest Ecology: Observation

This senior level elective field course emphasizes the development of observation skills by allowing students to collect data from a forest site as a class project (with a prescribed experimental design), analyze the data, then formulate their own group project based on their initial class observations, and return to the site two weeks later to carry out their own experimental design. This format allows students to practice a step often skipped under the pressure to fit a research project into a single quarter.

Biology 3: Hypothesis Development

This required lower division lab course emphasizes hypothesis development by asking students to perform library research on plants with antimicrobial potential, and then to use this research to select a plant to test extracts for activity against close relatives of plant pathogenic bacteria and fungi.

Marine Ecology: Experimental Design

This senior level elective field course includes five mini-research projects that are planned and analyzed by pairs of students, but executed by all students during our field trips. This allows us to visit a range of sites across Washington state, while still having a rich research experience. The design also gives advanced students an opportunity to practice leadership skills. Students have researched the niche partitioning of a native and invasive seagrass species in Willapa Bay, the effects of ocean acidification on sand dollar larvace in Friday Harbor, and the effects of a plume of high pH groundwater on benthic communities in Commencement Bay.

Biology 2: Data Collection

This required lower division lab course allows students to collect data on market substitution of Atlantic salmon, which is mostly farmed, for Pacific salmon, which is mostly wild-caught. They bring in their own samples, then use DNA sequencing and phylogenetic analysis to detect substitution. While the methods are prescribed, the students’ data have been published in the scientific literature (Cline 2012). The project provides a context for understanding the usefulness and application of techniques of molecular biology connected to real-world, use-inspired research.

Conservation Biology in Practice: Data Collection

In this upper-division elective course, students study the existing DOE report, meet the scientists who work on the project, learn some basic invertebrate zoology (“just in time”), sample new sites from a boat, quantify animals in their samples (with different groups of students becoming “experts” in various taxa), do a range of biodiversity calculations, and work together to create a single large report for submission to DOE and a local non-profit whose mission is the conservation of Commencement Bay.