

Biology Seminar

By: Dr. Jennifer Doherty

University of Washington | Principal Lecturer, Department of Biology

<https://www.biology.washington.edu/people/profile/jennifer-doherty>

Principle-based reasoning instruction: A strategy for developing expertise in Physiology



Wednesday, January 22, 2020 | 12:00pm
HCK 132 Refreshments at 11:45am

To gain expertise in a field is to recognize, understand, and be able to effectively reason using disciplinary principles. Principle-based reasoning provides students with a “way of thinking” that supports intellectual coherence. Mastering these principles is key to enabling students to transfer their understanding to new situations rather than relying on memorizing steps. In physiology, students can use the principles of flux (flow down gradients) and mass

balance (Conservation of Mass) to explain physiological systems that appear superficially distinct but are fundamentally related (e.g., neurons and guard cells).

My lab has developed the first reasoning framework describing how students develop principled-based reasoning in animal and plant physiology. To generate this framework, we created over 80 open-response questions on flux and mass balance. We have used these questions to interview 128 students and collect answers from over 6,700 students. To facilitate widespread use of the framework and questions, we used machine learning to create computer-scoring models that automatically score student answers within minutes and sends their instructor an interactive feedback report detailing the levels of reasoning of their students’.

Using the framework and computer scoring models, we surveyed a national sample of physiology courses. Results indicate that current instructional methods are not optimal for helping students gain the ability to use principle-based reasoning when solving physiological problems. I will share the progress my lab has made helping students embrace principle-based reasoning by using an innovative teaching method: inventing with contrasting cases.

Seminar Speaker Host: Barbara Wakimoto

