TEACHING STATEMENT
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My primary goal as an educator is to help students learn to solve complex problems in biology. This involves supporting them as they build conceptual frameworks and a rich library of biological examples. It also includes frequent practice of problem-solving skills such as synthesizing information, identifying relevant questions, and breaking a complex problem down into pieces that they can solve. Whether students continue in research, medical professions, or other areas, such skills are an essential part of a biology education.

In the classroom, I work to break down novel complex tasks into components that students can master individually. This includes progressing from simple practice problems to analyzing real-life situations, building skills such as designing and testing hypotheses or writing sections of lab reports until students are able to carry out an independent investigative project, and learning strategies for reading and discussing the primary literature.

In my classes, students have multiple opportunities to practice problems of varying complexity. In some courses, such as Genetics, this includes daily practice problems addressing class concepts; students reported that these questions were useful in learning the material, and helped them feel more confident approaching the exams. After some practice, we often move on to questions that focus on applying course concepts or methods to real challenges, such as breeding high yield plants or advising patients on the risk of inheriting a genetic disorder. I use a range of strategies to give students opportunities to practice, incorporating clicker questions, problem sets, and other activities into primarily lecture-based courses, both large and small.

I also work to provide students with tools to organize their thoughts and categorize new concepts before moving on to more complex applications. I started using these strategies when I was a TA in Evolutionary Genetics, where students were struggling to interpret the results of tests for selection because they couldn't keep the details of each method straight. After I introduced a comparison matrix in which students summarized each test and described the expected results under different selection regimes, student performance on the lab assignment increased noticeably. Since then I've used similar tools in other courses, including comparing types of photosynthesis in Plant Physiology, traits of different taxa of plants or protists in a biodiversity section of an introductory course, statistical methods in Introduction to Research, and types of regulatory sequences and transcription factors in Genetics. In all cases, students filled out the matrix prior to using that information to address more sophisticated problems. Students have reported that having these structured ways to organize their knowledge helps them apply these concepts more effectively.

Reading the primary literature is a highly complex task; before students are able to engage with the data and conceptual background of the paper, they have to persist through a complex format and sometimes opaque language and jargon. I found that when my class was discussing papers we often fell into more empahsis on the latter, even though being able to understand the implications and importance of a paper was my ultimate pedagogical goal. In order to ensure that students were able to interact directly with key concepts, I started using "interrupted case studies" in upper-level courses. These case studies take a paper and break it down into sections;

the first part introduces the background and central questions of the study and has students make predictions about the findings, the second presents figures and has students reflect on the data, and the final section has them consider how the results have answered the central questions and the broader importance of the work. I've written case studies about traits involved in drought resistance for Plant Physiology, and the roles of adaptation vs plasticity in guppies for Evolutionary Genetics. In both cases the competing hypotheses and data were complex, and reading the original papers would have been a substantial challenge for students; presenting it in a simplified, streamlined format let them focus on the biology instead of the task of reading the paper. I've also adapted the format to write simpler versions for a non-majors class, which helped meet course goals of analyzing and interpreting data.

Students build on these skills of analyzing experimental results by interacting directly with the primary literature. This was particularly prominent in my upper-level Genetics course, which included extensive discussion of the literature in the field; we approached it from a historical perspective, reading and discussing some of the fundamental papers in the discipline. Although many students found these papers challenging, by engaging with them they gained a deeper understanding of both the concepts we were discussing and the process of doing science. At the end of the semester they choose a topic and led a class discussion of a paper themselves.

As scientists, many of the complex problems that we solve are in an experimental setting. In order for students to practice both practical and conceptual problem-solving in a scientific context, I prefer to incorporate inquiry-based lab exercises into courses. In some courses these have been small projects carried out in one or two lab sessions, such as an experiment investigating plant hormones and seedling growth. In my Evolutionary Genetics course, students began the semester analyzing data in R by filling in variables in a template script that I provided; by the end of the semester, they were independently analyzing open-access datasets that they'd found to answer a question of their own design. Several students told me that starting with the outline scripts gave them a better understanding of how to perform more complex analyses in R, and gave them the toolkit to be successful and independent in their final project.

I take equity and achievement gaps in the classroom as critical challenges. Acknowledging that innate biases are inevitable, I seek both to understand mine, and to create a course design and classroom environment that minimizes their power. This includes using rubrics to make grading more transparent and less subjective, and incorporating course design elements, such as student-driven and inquiry-based learning, that have been shown to support increased success among under-represented groups. I also reach out directly to all students who perform poorly on the first exam and ask them to come talk to me about strategies for success; this has increased the number of students at my office hours, including students from under-represented groups. I emphasize a growth mindset, explicitly saying in class that all students are capable of improving if they work hard, use effective strategies, and ask for help when they need it.