Teaching statement

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Teaching philosophy and goals

My teaching philosophy focuses on fostering a passion for learning and giving students the tools for continuous self-improvement and lifelong learning. As an educator in Biomedical Engineering that is a highly interdisciplinary and rapidly evolving field, I prioritize problem solving, critical thinking, and teamwork as foundational to students' long-term success. In my classes, by integrating hands-on learning experiences with theoretical knowledge, I strive to cultivate an environment that encourages curiosity, inclusiveness, and personal and team growth.

Teaching experience

With a training background in biomedical engineering (BME) and biology, I aim to teach students in these fields. My first teaching experience was as a teaching assistant for an undergraduate-level BME course (BME260 modeling molecular and cellular systems), which focused on using mathematical modeling to simulate biomedical and biotechnological processes, such as pharmacokinetics, fermentation in bioreactors, and the spread of infectious diseases. The core of the course was to transform real life scenarios into mathematical equations and, through computational solving and optimization, students can find solutions to targeted outcomes, such as how to administer a drug with maximum efficiency or how to prevent disease spread. My responsibilities were several. The students, primarily juniors and seniors in BME, were introduced by me to the basics of conducting research, such as literature search and parameter selection for their mathematical models. I gave lectures on these topics and held weekly discussion sessions where the students worked on group project. In each session, there were approximately 30 students or split into 6 groups.

In these sessions, I encouraged creativity by asking the students to think outside the box and incorporate trendy topics that interested them. Consequently, the group projects were highly creative and tailored to the students' interests, such as exploring how to produce high commercial value proteins with microbes in a bioreactor. They were not only keen on these topics but also learned significantly by researching these proteins and understanding the industrial manufacturing processes. Besides, I believe any techniques (such as modeling) are only useful to some extent for solving tasks. More importantly, if students can build up critical thinking and make rational decision about choosing tools and methods, they can excel anywhere. Therefore, I encouraged them to discuss their reasoning in groups, explain their thought processes to each other and to me, and ponder why certain assumptions may or may not be true. Encouraging this mindset not only prepares them to handle complex challenges but also equips them with the adaptability required in today's fast-evolving technological landscape.

Through weekly reports, I ensured their projects were on track, which taught them project management and teamwork, and also allowed me to assess their learning. If they were off track, I provided feedback in the following weeks. Midway through and at the end of the semester, the students also evaluated their own and each other's contributions, fostering self-reflection and encouraging them to consider what they had learned and areas for improvement.

Having taught this course twice, I believe there was tremendous improvement not only among the students but also in my ability to explain complex concepts, quickly identify students' needs, and teach students from different years and majors. I found that diversifying teams fosters creativity due to the different perspectives students bring and the opportunity to learn from each other's strengths. I also had a student who was an athlete and often needed to attend training and games. I learned that as a teacher, it is crucial to communicate clearly what needs to be done and encourage them to use other communication methods, such as online chat apps, to maintain team communication.

After the initial experience, I have strived to continually improve my teaching skills and establish my teaching philosophy. I found that my colleagues and mentors were invaluable resources, as I actively seek their advice and observe their classes. I also plan to shadow seasoned educators to learn how they prepare for lectures, teach diverse student groups, and handle challenges. For example, with the advent of new technologies such as ChatGPT, it is essential to teach students how to use these tools effectively to enhance their learning while ensuring the learning outcomes. I will continue to learn from my teaching mentors about guiding students through new technologies. The pedagogy courses I took as part of the Certificate in College Teaching program were also invaluable resources for refining my approach to course design.

Pedagogy training

Through the Certificate in College Teaching Program and departmental training at Duke, I have completed coursework and participated in peer feedback to improve my teaching skills:

- GS750 Fundamentals of college teaching
- GS755 College teaching course design
- Teaching triangle
- BMES 728S Teaching seminar 1
- BMES 729S Teaching seminar 2

Courses I can teach

I can teach mathematical modeling, synthetic biology, biodesign, iGEM, and etc.

The core of these courses encompasses utilizing computational tools (mathematical modeling, machine learning) for understanding and designing biological systems. The experimental components include the basics of synthetic biology, cell/molecular biology, and microbiology. The target students are undergraduate students in Biomedical engineering, biology, biophysics, or other quantitative biology fields.

Original teaching materials

To support my teaching, the following has been developed:

1. Code repository for modeling molecular and cellular systems. It contains Python scripts for modeling chemical reactions, gene expression, cell growth, cell dispersal and etc. It is suitable for BME junior/senior level courses focusing on modeling.
2. Introduction of bacterial arts. Bacteria can form beautiful patterns, and scientists are interested in understanding how these patterns emerge. The slides provide an overview of this topic, discuss the principles of biotechnology tools and modeling approaches, and summarize the applications. This is suitable for BME special topic courses, such as Synthetic Biology and Biodesign.
3. Tutorial slides on high performance computing, which is a critical computational skill in the field of quantitative biology. The slides cover the background and provide hands-on guidance on the compute clusters and packages. They are suitable for BME senior level courses that emphasize on modeling.
4. Bacterial colony morphology database contains microscopic images of bacterial colonies. This novel database has been constructed to enable students to apply computer vision algorithms, and build machine learning models for studying bacterial phenotypes. It is suitable for ECE biomedical image analysis and BIO (clinical) microbiology courses.