Incorporating Sustainability into BIOE 120 (Biology for Engineers) course

Every semester, I instruct a freshmen level introductory course for interested bioengineering majors. Biology for Engineers (BIOE 120) is a course that targets approximately 150 students every semester. The range of engineering majors span from chemical engineering to civil engineering along with students from other disciplines (e.g., psychology). The introductory course aims to teach students about the quantification and measurement of biology using mathematical and engineering tools and methodologies.

Over the past semester, many students have expressed interest in Civil and Environmental Engineering topics such as wastewater treatment, biofuels, and metabolic engineering. I believe that demonstrating to the students about methods and techniques that ensures sustainability in one or more of these areas can pave the way for an impactful class.

As part of my contribution to the Chesapeake Bay Project goals, I am interested in preliminarily incorporating two lesson plans that revolve around sustainability for my BIOE 120 course. Lecture 7 focuses on bacterial growth. Bacteria is a very important factor when considering the development of biofuels and alternative fuel sources such as ethanol based fuels. Within the bacterial growth lecture, I could include a problem statement related to finding more sustainable and cost effective fuel sources (i.e., using wood chips versus using corn) and have them track down and quantify the amount of alcohol produced by the bacteria. In addition, I would have them compare and discuss whether their assessments can lead to a more sustainable result or not.

Along the same lines, Lecture 8 will expand upon bacterial growth and incorporate a talk about biofilms. Biofilms provide harmful by-products that result in compromised fish-life especially in freshwater systems. Biofilms is also extremely dangerous in wastewater treatment facilities as it can accumulate in the pipelines and lead to excessive chemical release that are difficult to isolate and control. This can affect the overall quality of our drinking water and health. Recently, engineers and scientists have begun to repurpose biofilms as "water-filtration" units by modifying with its genetic information and overall chemical output. The re-purposed biofilm is currently being tested in military settings to purify water from areas where clean water may not be accessible, especially from those areas found during combat. I believe we can have students analyze these water filtration systems and discuss the impact these systems can make in reducing diseases in fish-life. Students can perform some in-classroom research and discuss the effectiveness and implications of this biofilm in sustaining water life. The topic can be expanded as part of a HW or a project where students will have to perform an engineering analysis of the technology and prepare to argument their findings in a debate or oral presentation.

I am including a copy of my tentative syllabus for the Fall semester demonstrating the addition of these lectures in my course. In addition, I am re-structuring the laboratory portion for this course (BIOE 121) and have begun talks with the laboratory technician to include more concepts about sustainability in this course. While I am interested in incorporating sustainability in BIOE 121, I do not expect to have all the laboratories and protocols prepared until next year. Thus, I am not including this syllabus but wanted to make the Chesapeake Bay Project aware that I am considering further changes in my other courses in the future.