ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #35125

Work In Progress: Conversion of Collaborative Problem-Based Learning Activities from Face-to-Face to Online

Dr. Charles Patrick Jr, Texas State University

Charles Patrick Jr. is a Professor of Practice in the Department of Biomedical Engineering, Texas A&M University (TAMU). He is also a teaching and research fellow at the Institute of Engineering Education Innovation, TAMU. He has worked in higher education for more than 35 years at state and private universities and an NCI comprehensive cancer hospital.

ABSTRACT

Biomedical engineering seniors at Texas &M University enroll in Mass & Energy Transport in Biosystems that traditionally is taught face-to-face using a blended approach of lectures and collaborative problem-based learning sessions. The three learning objectives are to (1) mathematically define and describe general biotransport problems, including deriving governing equations and defining appropriate boundary and initial conditions (2) solve and analyze a variety of basic biotransport problems, and (3) develop transport models and approaches to biomedical problems and critically evaluate the solutions. Class activities span lower to higher order levels of Bloom's Revised Taxonomy and require application of multivariable calculus and ordinary and partial differential equations.

Face-to-face, collaborative problem-based learning activities consist of student groups (4-5 students/group) developing numerical and analytical solutions to 35 biotransport problems throughout the semester. Students actively dialogue and solve the problems, whereas the professor and teaching assistant roam the classroom to facilitate problem solving only when groups reach an impasse. The response to the 2020 COVID-19 pandemic disrupted this teaching plan, resulting in the math-intensive course moving to online delivery. It was critical to ensure the student-centered active learning activity of collaborative problem-based learning was maintained during imposed changes in course delivery format.

To ensure teaching continuity in the curriculum and to address the intended learning outcomes, the biotransport course was converted from a face-to-face to a blended online course consisting of asynchronous mini-lectures, synchronous "muddiest points" forums, and synchronous collaborative problem-based learning sessions. The extent learning outcomes were met and the journey of converting the collaborative problem-based learning activities from an in-class to online environment will be assessed and discussed. The final form of the online collaborative problem-based learning activities consisted of groups of students synchronously developing numerical and analytical solutions to biotransport problems in Zoom breakout rooms and the instructor joining the break out rooms when needed to facilitate problem solving.

Four semesters (fall 2019, spring 2020, summer 2020, and fall 2020) consisting of a total of 262 students will be analyzed. Fall 2019 and 60% of spring 2020 were taught according to pre-COVID-19 pedagogy. The remainder of the semesters analyzed were taught under COVID-19 conditions and pedagogy was converted from face-to-face to online format. A 15-question survey was used to evaluate problem-based learning through a five-level Likert scale: 1–not at all, 2–a little, 3–somewhat, 4–significantly, 5–a lot. This survey was employed prior to and during COVID-19 restrictions. Instructor reflections on course conversion, student engagement, and professor-student communication will be included in the final analysis comparing face-to-face and online collaborative problem-based learning. Appropriate statistical analyses will be used for all comparisons.