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Stay calm and focus on the learning outcomes: Tools for taking biophysical chemistry online

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Stay calm and focus on the learning outcomes: Tools for taking biophysical chemistry online

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Abstract

Course specific learning outcomes are an important tool to define the scope of a course and can be very helpful when designing experiments and assessments. With slight modification, these learning outcomes can serve as a guide when transitioning to the distance learning format especially in courses with a traditional lab. Here we present such an example for the biophysical chemistry course.

KEYWORDS

biophysical methods, COVID-19, distance learning, learning outcomes

Upper level science courses typically require a great deal of hands-on experience. They are designed to build experimental acuity in students through a hands-on approach, highlighting instrumentation and data acquisition. The recent COVID-19 pandemic has forced many universities to run their laboratories online. This has opened up an opportunity to rethink the entire laboratory experience and its learning outcomes. Through a hands-on approach, distance learning laboratories can attempt to build experimental skills by focusing on data analysis, results, and scientific communication.

Biophysical Chemistry, at Nova Southeastern University, is a one semester 3000 level course with associated laboratory. Although most of its learning goals can be rapidly translated to a distance learning format, goal #6 "*Perform experiments with instrumentation to measure and calculate physical properties of materials*" must be redesigned to accommodate for the lack of access to a physical lab and specialized instruments. For online delivery, this goal is rewritten as: "*Analyze data obtained from various repositories to calculate physical properties of materials and communicate results in clear scientific writing.*" For example, the "*Drug-excipient interactions*" experiment was redesigned for distance learning following goal #6. In this lab, students detect incompatibilities between a drug and an excipient through thermal analysis techniques.[1–4] After a short introduction to the relevant techniques, groups of 3 to 4 members are given previously collected data. They are asked to analyze the data for drug stability, thermal behavior of the binary mixtures (drug-excipient), and compare the drug-excipient data with the one from the drug and excipients alone. Finally, groups write a report that is peer-reviewed by their classmates. The experimental procedure and assessment design was guided by these two learning outcomes: (a) Analyze drug-excipient interactions on the chemical level, and (b) Describe the thermal analysis instrumentation and software.

The task of designing effective learning outcomes, to articulate and solidify anticipated student gains out of any course, can be very difficult even under normal circumstances. Nonetheless, many tools are currently available in previously published frameworks.[5–9] For example, Pelaez et al.[5] breaks down the seven areas of competency for biology students, while Irby et al.[6–7] publications detail the development of specific ALOs for a semester long research-based biochemistry curriculum.[10] CURE based curricula, like the BASIL project represent a very robust method to teach complex scientific topics.[11–12] The frameworks described in this paper served to guide the development of our learning outcomes. Moreover, the principles applied to our specific case can also be applied to any distance learning STEM course.

Current events have made the shift to distance learning a necessity for many universities, it has become clear that these teaching methods will only become more prevalent in the near future. Therefore, maintaining the quality and rigor of upper level science courses will require a thoughtful translation of current learning outcomes to the distance learning format. This is not only sensible, but it is essential if we are to adapt to this changing world.

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