

## Chapter 79

# Blend the Lab Course, Flip the Responsibility

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### ABSTRACT

*An upper-level special topics course in Applied, Environmental, and Medical Microbiology was offered for the first time. It was decided by the author to offer it as a blended course. There were some compelling reasons to do so: first and foremost, it allowed class time to be spent doing what one should in a lab-intensive course: remark on current state of knowledge and literature, describe experimental design, discuss potential outcomes, troubleshoot technical problems as they arise, and offer suggestions regarding students' research throughout the process. The ultimate goal and real value of the blended classroom in this instance was elevating the level of student responsibility and forcing them to view a science class as something more than a collection of facts: rather as a very active class, one that requires individual action. It was also designed to allow the students to participate in fundamental scientific research with the help of a mentor in a manner that was/is still practiced and in full view of peer review. The role of the faculty member changes to one of providing guidance instead of content in the classroom, and so it gives one more individual time with the students; this time can be used for diagnostic, formative, and summative assessment.*

### INTRODUCTION

The blended classroom provides a means to off-load some of the content of a course to online media and allow more of the classroom to be used for interactive dialog with the learner. This strategy makes logical sense for certain courses, and is especially useful with motivated learners who will responsibly prepare for the face-to-face time. The synchronous and asynchronous interac-

tions each have their strongpoints and when both are used effectively it can have a synergistic effect on the learning.

A challenge for any discipline is how to best transition the beginner in the field, the novice, to a position of mastery. This is particularly true in the sciences where not only is there a large, ever-expanding content base, but there is also the technical knowledge and skills needed to design an experiment as well as a way of approaching

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the subject, all of which is foreign to the beginner. The mechanics of an upper-level advanced special topics in microbiology operated in a blended fashion are described in this chapter. This was the first time for the faculty member to run the course and it was one of the first courses with an online component for many of the students. Students worked in groups and were responsible for formal experimental write-ups as well as online videos outlining their background information, their methodology and experimental design, their results, and their conclusions. The students worked progressively through a series of experiments, starting with well-defined studies to those that were more exploratory in nature and had a large inquiry-based component. The final projects were in conjunction with a primary investigator and the results of their studies were of high value to the scientific community.

## **BACKGROUND**

### **Lessons from Psychologists on Cognition**

Cognitive load theory (Sweller, 1988) maintains that we possess a very large long-term memory in which we develop schemas. It is within this framework that knowledge is stored. Learning is the construction of such framework. From this theory it follows that optimal instruction would involve providing novice learners with many examples of problem sets that have been worked through rather than asking them to perform problem-solving.

So how best to deal with complex tasks and ask the learner to draw upon their memory to draw an appropriate conclusion? Scientists confront this situation as they design experiments to address new questions. It is also valuable for a healthcare professional confronted with a patient with an unknown illness or malady. It is for these reasons

that educators have begun to use authentic real-life scenarios that could presumably ask the student to draw upon their knowledge and skills to perform a particular task.

The old adage that practice makes perfect holds true in the many professions, senior physicians are able to quickly come to the correct conclusion as they hold the entire complex spectrum of an affliction as something that can be used in their working memory. A novice would not have built a correct schema, especially in a novel situation, and hence has little memory to draw from. Trial and error is not an option, as there are too many potential options, most of which will lead to costly errors.

Therefore if too much unconnected, unfamiliar information is provided to the learner, they will undoubtedly fail based on cognitive load theory (vanMerriënboer & Sweller, 2010). Inadequate instructional design may lead to overloading the working memory capacity of the learner. There are a number of strategies that are effective based on what we know about cognitive load theory. Several have been outlined by vanMerriënboer & Sweller (2010): create goal-free tasks where there may be multiple solutions; provide students with worked examples that they may critically analyze; provide a partial solution that students must complete; deliver just-in-time teaching so as not to provide everything up front; give simple problems to work through first then add ones with higher complexity; add scenarios where the outcome is the same but with different variables to further expand the rule set; ask learner to self-explain the information as they see it; allow learner to criticize worked examples and then provide their own explanations; and provide ample guidance initially but gradually remove to the point where there is no guidance.

Cognitive load theory holds that there is a particular, relatively small level of working memory at any one point but a large long-term memory from which to create it, therefore there is a cognitive load at any one point. The research regarding

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