Chapter 16
The View from a Flipped Classroom:
Improved Student Success and Subject Mastery in Organic Chemistry

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ABSTRACT

Flipped classroom pedagogy is one that is applicable for a multitude of disciplines and for course enrollments of various sizes. The focus of this chapter is to demonstrate the pedagogical effectiveness of flipping by describing the methodologies and assignments used in a flipped Organic Chemistry I course and by assessing the performance and experiences of students in a flipped course in comparison to those in a not flipped control section. Historical data and learning outcomes of students in not flipped courses is discussed as indicators of why the flipped pedagogy was implemented. Both quantitative and qualitative data are analyzed, along with the challenges and best practices for flipping. The findings have useful implications for educators interested in flipping their own classrooms, as well as for the researchers and administrators who support them.

INTRODUCTION

Although teaching is a respected and much-lauded profession, it is also at times a difficult one and requires much introspection and continual growth. Teachers wield a tremendous influence over each successive generation of students, but the only real power each teacher has is to set the stage for the learning environment. The best question each teacher can ask is this: What do the students need me for?

The answer to that very question is at the heart of the flipped class pedagogy. Professional educators conduct flipped classes in many different ways. The major commonality is in the desire to structure the learning environment so that the teacher is present for the learning tasks where the students need her most, while other learning tasks are conducted in the individual learning spaces. Flipping frequently allows for more in class time on formative assessment, giving students feedback on their learning progress

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and study habits prior to the submission of high-stakes summative assessments (exams, papers, projects, etc.). The positive outcomes of flipping can assist students with not only their subject proficiency, but also in their engagement in their own education.

This chapter provides an in-depth look at the way in which flipped pedagogy was applied in a college-level organic chemistry course. The change was effected in order to redistribute in and out of class activities. Prior to the implementation of flipped pedagogy, the course had a high failure rate and a low GPA, and those unfavorable results were getting worse as class sizes were increasing. By flipping some course content to out of class time via video lecture, the students in the flipped course were able to engage with the material and to regularly receive low-stakes feedback in class on their understanding of course content. The flipped pedagogy resulted in improved student performance on the high-stakes graded assignments, statistically significant improvement in passage rates for the course, and a high-level of student buy-in for the methodologies used.

BACKGROUND

Technology is an educational disruption that seems to have much staying power. Multiple tools and strategies are now available that did not exist even a decade ago. However, technology simply added on to existing courses does not make a large impact in learning (Twigg, 2003). Rather, a complete rethinking of the academic experiences involved in a course can help to shift from a content-centered to a learning-centered environment, altering the learning experience for the student (Fink, 2003).

It is the responsibility of the teacher to examine the time spent in and out of the classroom on assignments and course-related activities. The challenge, however, is that students have varying abilities and interests in each academic subject and typically have a myriad of activities competing for their time. The modern educator must structure educational activities to be worthwhile or the student will avoid completing them. A common mistake made by many teachers is to assign readings or activities that are not used in class or to summarize them in class and thereby give the students a loophole for never fulfilling the expectation in the first place (Bowen, 2012). Teachers must respect the students enough to make class interesting and provide engagement that they cannot receive elsewhere. At least some time in class should regularly be reserved for working on active pedagogies. Students may be initially resistant to the unknown, but as they become familiar with new techniques, they adapt and develop positive attitudes about instructors' new methodologies and uses of technology (Dahlstrom, Walker, & Dziubah, 2013).

Many faculty, particularly in STEM (science, technology, engineering, and math) disciplines, rely heavily upon lecture-based pedagogies, which can frequently result in students passively writing down notes along with the professor without actually thinking or learning at all (Khan, 2012; Mazur, 2009). In a sage on the stage approach, the teacher is the star of the classroom, delivering facts and concepts to an audience from a prepared script. In an alternate scenario, the teacher acts as a guide on the side, assisting students through the course content, but largely allowing them to encounter it on their own. In reality, educators tend to be well-versed in a variety of teaching techniques and move, not from one extreme of a binary spectrum to the other, but among a variety of pedagogies within their courses each day (Cardellini, 2013; Cox & Yearwood, 2013). Faculty may often use lectures because the pedagogy allows the most control over content. Interactive learning comes at the cost of loss of control, and each teacher must determine the best techniques to use within each class each day.