

A Novel Educational Experience: A Hybrid lab course In a Microbiology Major

Macarena Urrets-Zavalía
Graduate Student
University of Florida
P.O. Box 110540
408 Rolfs Hall
Gainesville, FL 32611
Phone: (352) 392-9585
macarenauz@ufl.edu

Dr. Sebastian Galindo-Gonzalez
Research Assistant Professor
University of Florida
PO Box 112060
113C Bryant Hall
Gainesville, FL 32611
352-273-0267
sgalindo@ufl.edu

Jennifer C. Drew
Lecturer
Main Office (1052)
Microbiology Building 981
Gainesville, FL
Phone: (352)392-1906
jdrew@ufl.edu

Alexandria Ardisone
Assistant Scientist
University of Florida
Microbiology Building 981
Gainesville, FL
lexi88@ufl.edu

Monika Oli
Undergraduate Coordinator
University of Florida

Room 1049
Microbiology Building 981
Gainesville, FL
Phone: (352)392-8434
moli@ufl.edu

Kelly Rice
Associate Professor
University of Florida
Room 1147
Microbiology Building 981
Gainesville, FL
Phone: (352) 392-1192
kcrice@ufl.edu

Eric W. Triplett
Microbiology Department Chair
University of Florida
Room 1248
Microbiology Building 981
Gainesville, FL
Phone: (352) 392-5430

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Introduction

In 2012, a report made to the President of the United States by the President’s Council of Advisors on Science and Technology suggested that, in order to maintain the current position of preeminence in science and technology, one million more STEM graduates will be needed (President Council of Advisors on Science and Technology, 2012).

To accomplish the goal of increasing the number of STEM graduates, providing opportunities to diverse demographics became paramount. As stated by Drew, et al., (2016) the need to broaden the participation of underrepresented minorities in STEM is more than evident. Likewise, for the National Science Board of NSF, diversity is one of America’s best advantages regarding competitiveness in STEM (NSF, 2018). Considering diversity as an advantage is important for universities to provide equal opportunities to different demographics.

Concurrently, during the past decade, online education has grown exponentially. In 2008, Allen and Seaman released a key report on higher education and online education in the USA. The report documented the shift that higher education had experienced in the past decade towards online education (Allen & Seaman, 2008). According to a newer report also released by Allen and Seaman, in 2012, more than 6.7 million of students were enrolled in distance education programs (Allen & Seaman, 2012).

In those circumstances, with a higher demand for online education and following the suggestion made by the President’s Council of Advisors on Science and Technology, the Department of Microbiology implemented, in the year 2011 a unique hybrid transfer program.

The implementation resulted on the need of making all the face-to-face courses also available for online delivery. However, due to the importance of a hands-on experience in a lab setting, the laboratory courses could not be delivered online. Hybrid condensed lab experiences were then implemented as an answer to this challenge. A commonly asked question for online programs, particularly relevant for some STEM disciplines, is ‘How effective a program can be with so little hands-on learning opportunities for students?’ (Elliott & Kukula, 2007).

How it works/methodology/program phases/steps

Two traditional semester-long lab courses were condensed into 5–day, intensive “bootcamp” versions taught on the main campus. The condensed lab courses have the same objectives, activities, skills, and assessments as their semester-long versions.

Before taking the condensed lab, the students complete an online, semester long, one credit course. That online class teaches them the basic concepts they will need to be able to work in a lab.

The summer following to completing the online course, the students can take the condensed laboratory courses. Each lab lasts five days with students attending class from 8:00

am to 5:00 pm. The students can either take both lab sessions back to back in the same year (basic and advanced) or in separate years, depending on the students' personal constraints and/or preferences. The courses are offered during the second and third week of May (during the break between spring and summer semester).

Condensed courses of this kind can be of help in emphasizing decision making and strategic thinking in students, given their similarity to real-life situations (Shaw, Chametzky, Burrus, & Walters, 2013; Vale, et.al. 2012).

Results

Quantitative and qualitative approaches were used to develop a comprehensive evaluation of the quality and effectiveness of the condensed labs.

The team delivering the condensed labs compared the students' outcomes between the traditional and the condensed labs. So far, no significant differences in course grades or GPA have been found. Additionally, the changes in knowledge from both formats are similar. Furthermore, focus group interviews were conducted with condensed lab' students, and the data show that students found the experience to be very valuable. Students reported enhanced knowledge and found the condensed labs challenging but more motivating and potentially more effective than a traditional lab (as compared against their previous experiences).

Future plans/advice to others

The results of this experience are, so far, very positive and show that the innovative approach used for delivering the lab course in a time restricted environment was successful and could lead new and more effective delivery ways for hands-on training in STEM education.

A new study will be conducted next year to make a more rigorous comparison of the traditional and. the condensed labs looking at students' knowledge gain, retention of content, and ability to apply the content. The study will also utilize Bloom's taxonomy to compare the cognitive outcomes exhibited by students that completed either the semester-long lab or the condensed lab.

Resources needed

The resources needed for implementing a condensed version of a course will vary between institutions. In the case of Microbiology, the professors teaching in the summer are the same that teach in the other semesters, in addition, all the lab equipment was already available to the department.

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