



# Engaging Nontraditional Students by CURE-ing Microbes on Ocean Plastics

Ana Maria Barral<sup>1</sup>, Rachel E. Simmons<sup>1</sup>, Marie Boman-Davies<sup>1</sup>, Jeff Bowman<sup>2</sup>, Emelia DeForce<sup>2</sup>

<sup>1</sup>National University, La Jolla, CA, <sup>2</sup>Scripps Institution of Oceanography, UCSD, La Jolla, CA



## Program number 617.1

### ABSTRACT

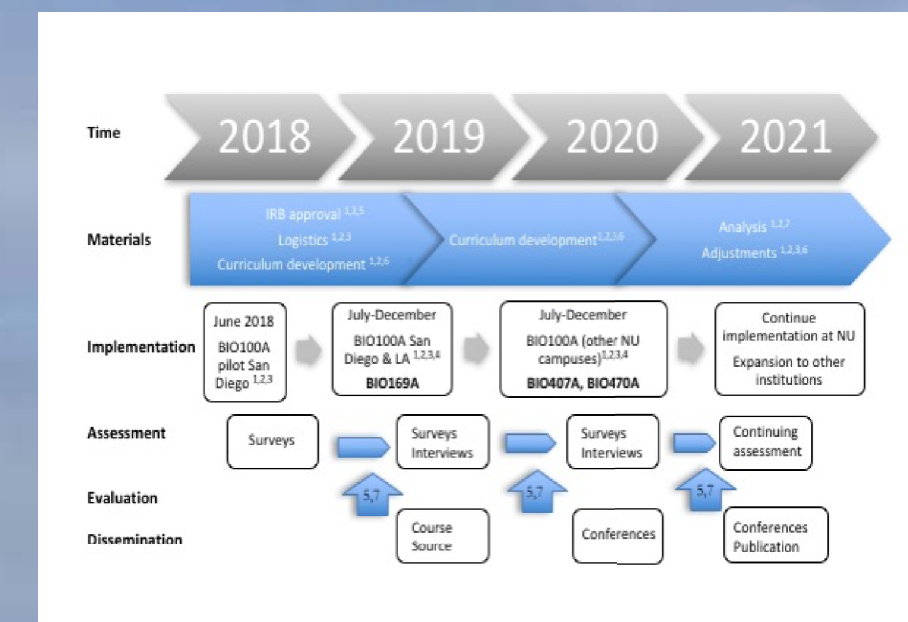
It is well known that learning occurs best when students are engaged with a topic that interests them or has relevance for important aspects of their lives. In coastal California, the health of the ocean is a serious local concern, and ocean plastics are ubiquitous. We have developed a course-based undergraduate research experience (CURE) on an existing research project addressing microbes colonizing floating plastic marine debris. The objective of the project is to increase student engagement and persistence in biology. The project (recently awarded an NSF education grant focused on Hispanic students) brings together National University (NU), an undergraduate teaching institution serving non-traditional students, with Scripps Institution of Oceanography (SIO), a world-renowned research-oriented institution at UC San Diego. A modular design allows students from different biology courses (both non-majors and majors) to participate in field and laboratory research while also interacting with research scientists and graduate students. Module contents range from classroom material including experimental design, hypothesis testing, and data analysis, to laboratory activities such as deployment of test materials, microbiology and molecular biology techniques, as well as bioinformatics.

Assessment of the project involves surveys and focus groups to evaluate student engagement, as well as institutional metrics such as retention in the BS Biology program. A pilot involving a non majors general biology course visiting SIO was well-received by students. Currently (November 2018) an extended intervention is underway with a majors general biology course. During the first week of class students learned about the research project via video material and class lectures. A half day visit to SIO provided them with field trip experience, laboratory activities, presentation about plastic research, and interactions with scientists and graduate students. In successive laboratory activities, students observed colony morphology, performed Gram stainings and colony PCR, practiced Blast searches and developed simple phylogenetic trees. We conclude that the framework can be successfully implemented in spite of time and logistical challenges. We anticipate implementing and disseminating this CURE as a widely applicable model for biology and ocean science education centered on contemporary topics of immediate interest to students.

## MATERIALS & METHODS

National University students (non majors & biology majors) participate in a research project where they visit Scripps Institution of Oceanography and collect plastic samples exposed to sea water. Depending on the course, they perform different microbiology techniques, DNA extraction, PCR, or data analysis. As part of the visit they also interact with SIO faculty and graduate students.

Students complete a survey addressing their knowledge of plastic research, competencies in laboratory techniques, and STEM careers after the field trip. Persistence and graduation rates will be followed using institutional metrics.



## Survey questions

4. Rate your knowledge about the Scripps Institution of Oceanography (SIO)
6. Rate your knowledge about the SIO research projects
7. Rate your knowledge about the methods used by SIO researchers
8. Rate your knowledge about STEM careers
9. Rate your knowledge of the plastic research project at National University
11. Rate your competence in laboratory skills
12. Rate your competence in problem solving
14. Rate your competence in applying the scientific method, including drawing testable hypotheses fro...
15. Rate your competence in techniques such as PCR and gel electrophoresis
16. Rate your competence in compound and dissecting microscopy, including fixing and staining of spec...
17. Rate your competence in classifying organisms according to basic principles of taxonomy, including...
18. Rate your competence in explaining the structure of prokaryotic cells, as well as differences bet...
20. Rate your ability to think like a scientist
21. Rate your interest in performing scientific research
22. Rate your appreciation of scientific research

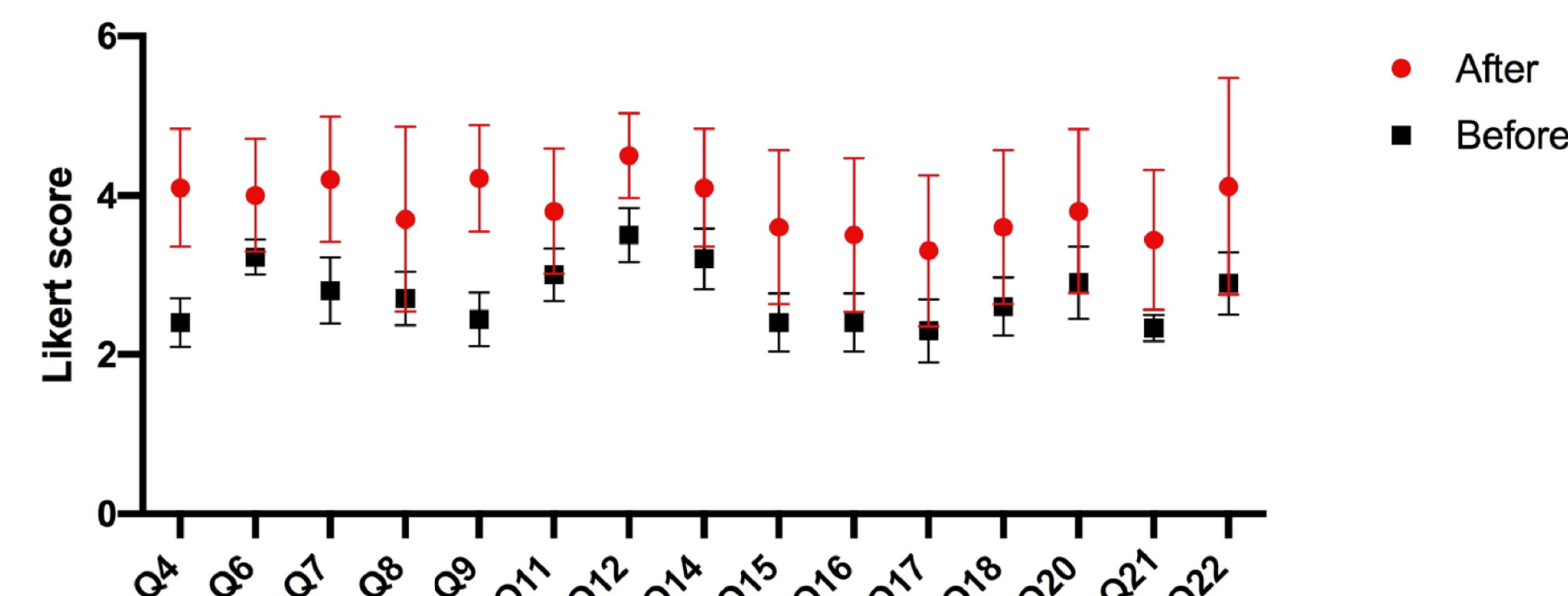
## NU Student Body

- Non-traditional students
- 28% Hispanic, 10% African-American, 10% Asian
- Mean age 32, many veterans & active duty
- Accelerated courses (1-2 month)
- AS & BS Biology

## RESULTS

Between October 2018 and February 2019 two nonmajors biology and one majors biology lab participated in the CURE. Survey results showed a significant difference using t-test for all questions before and after the field trip. Student feedback was overwhelmingly positive.

## Survey results before and after the field trip experience



Significant ( $p < .01$ ) for all questions using paired t-test  
N = 18



## CONCLUSIONS & FUTURE STEPS

1. CURE has been successfully implemented in non-majors and majors general biology courses.
2. Students knowledge & perception of STEM careers, ocean plastic research, and laboratory/biology skills was significantly higher after the field trip experience.
3. CURE will be expanded to upper division biology courses in the near future.

## ACKNOWLEDGEMENTS

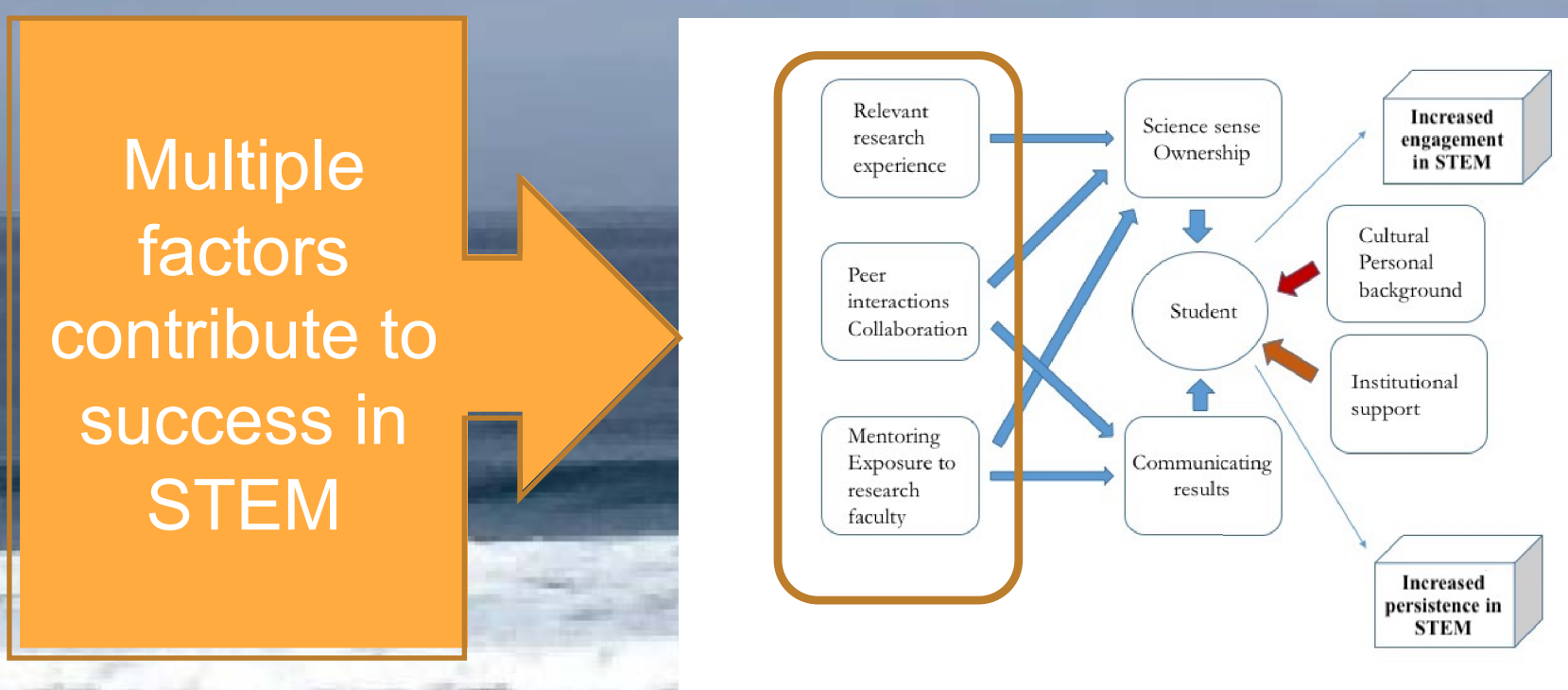
The authors wish to thank Dr. Kurt Steuck for data analysis, SIO graduate students Emelia Chamberlain, Natalia Erazo, and Srishti Dasarathy, and NU undergraduate students Jose Alvarado, Allison Leask, Meagan Rhodes, and Ben Stenson.

Author contact: [abarral@nu.edu](mailto:abarral@nu.edu), Twitter @Bio\_prof

Please come to spotlight talk M 2.30 PM Room W306AB

NSF HSI's new to NSF award #1832545

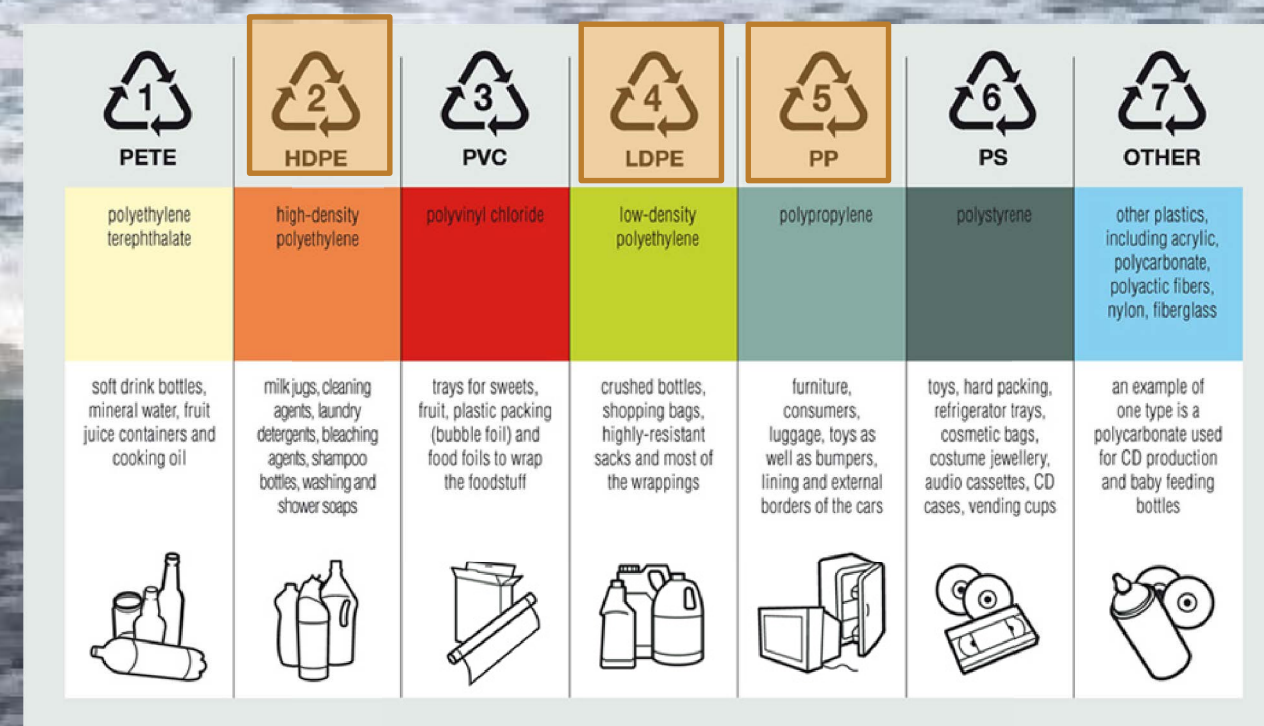
Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation



This projects provides support on multiple factors, while exploring others

## INTRODUCTION

Undergraduate research has been shown to enhance minority student success in STEM disciplines. CUREs allow the “scaling-up” of individual research experiences to a whole class by incorporating it into the coursework. Our project combines an attractive and relevant research topic (microbial colonization of floating plastic in the ocean) with a modular coursework applicable for non-majors and majors biology courses.



Our research focuses on floating plastic: HDPE, LDPE, & PP