

CUREing Ocean Plastic Microbes: Positive Experience of Engaging Non-traditional Undergraduate Students in a Hispanic-Serving Institution

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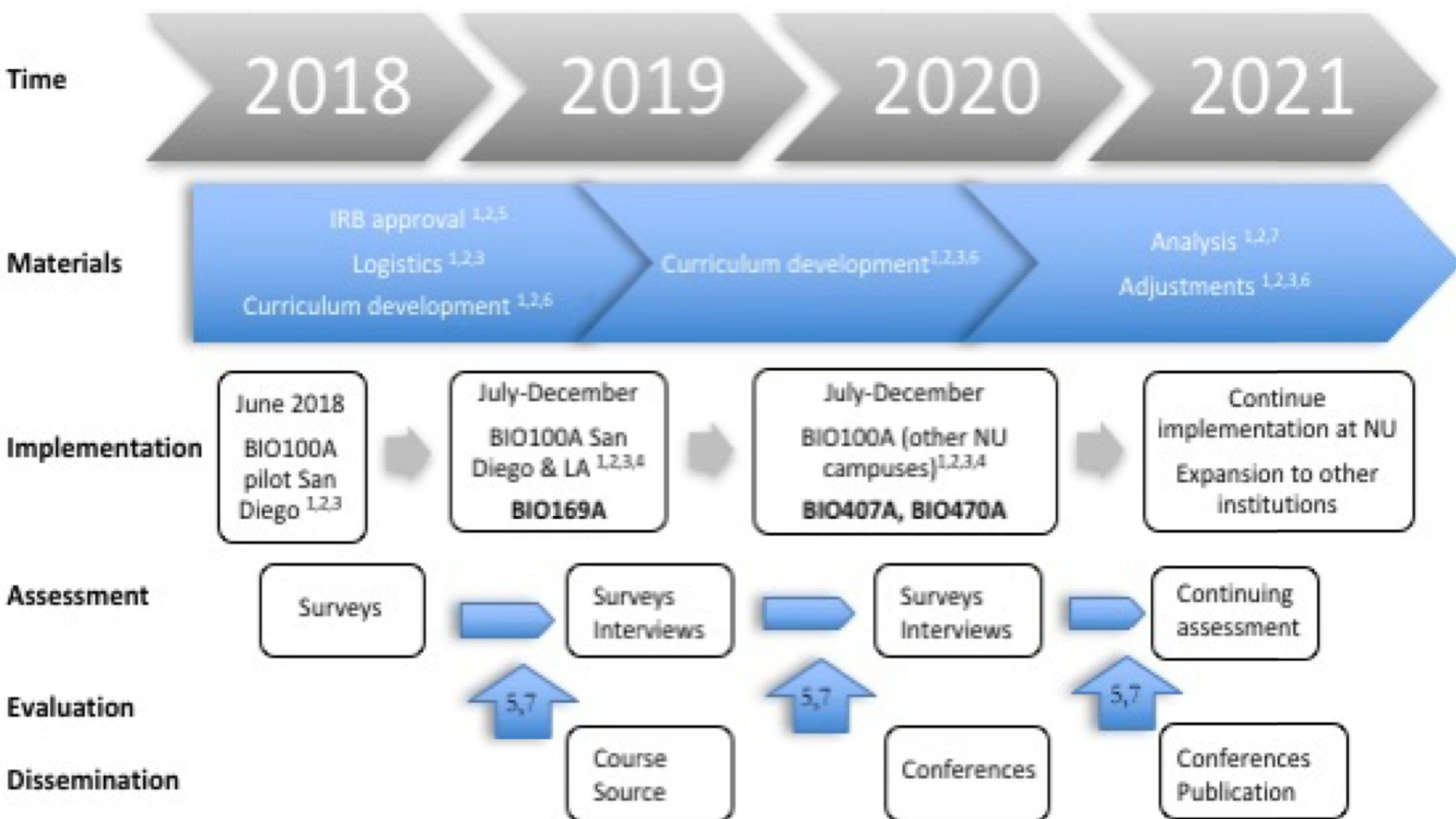
INTRODUCTION

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.

MATERIALS & METHODS

National University students (non majors & biology majors) participate in a research project where they visit Scripps Institute 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.



OCEAN PLASTIC PROJECT

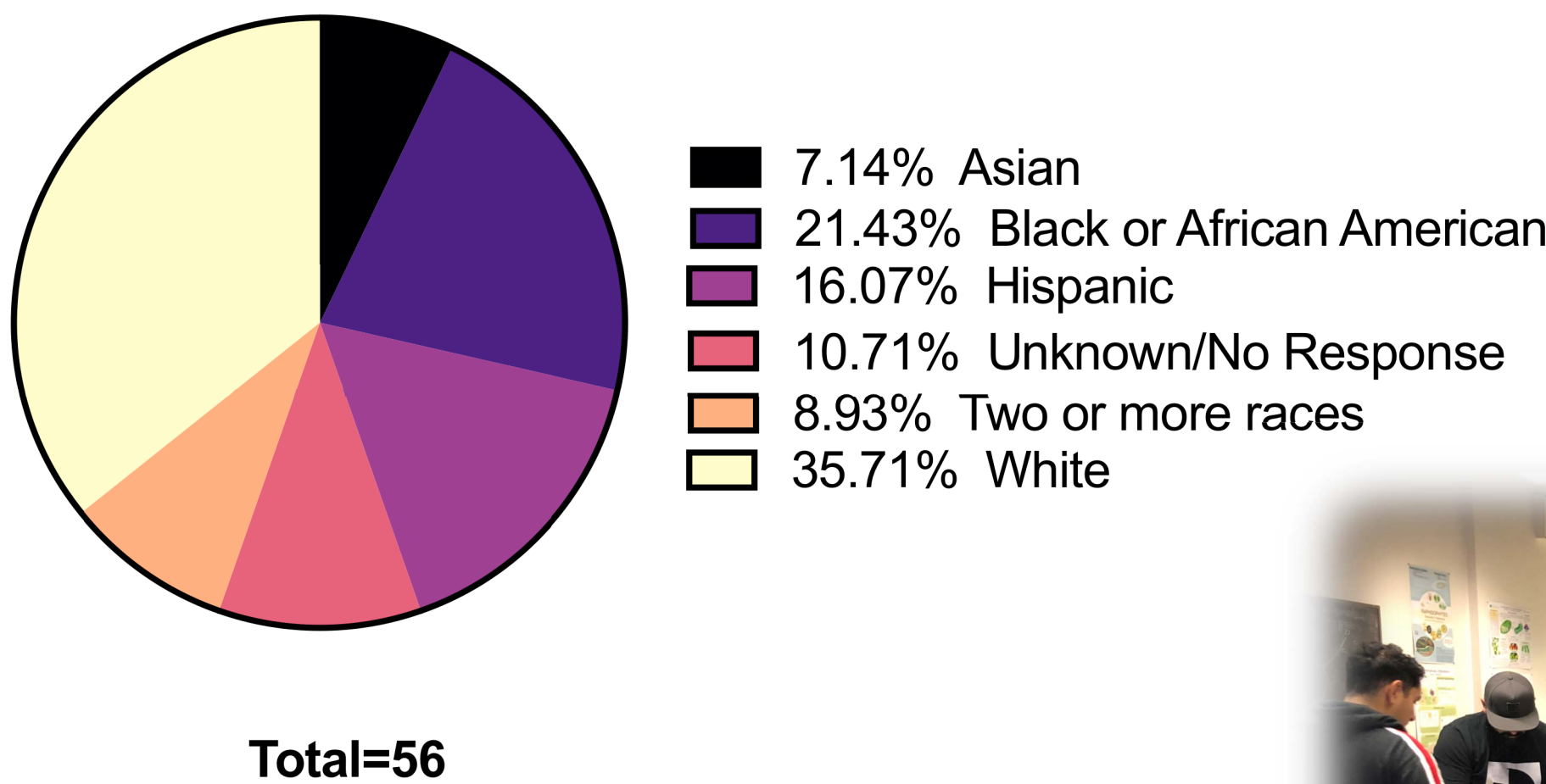
The research underpinning this CURE is an ongoing project characterizing microbes attaching to floating plastic. Different types of floating plastic (high and low density polyethylene and polypropylene) is submerged in water for >30 days, and the attached microbial biofilm is assessed using 16S metagenomic sequencing, culture on general and differential media, chemical degradation using FTIR, and SEM.

1 PETE	2 HDPE	3 PVC	4 LDPE	5 PP	6 PS	7 OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyacetic fibers, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning agents, laundry detergent, bleaching agents, shampoo bottles, washing and shower soaps	trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars	toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	an example of one type is a polycarbonate used for CD production and baby feeding bottles

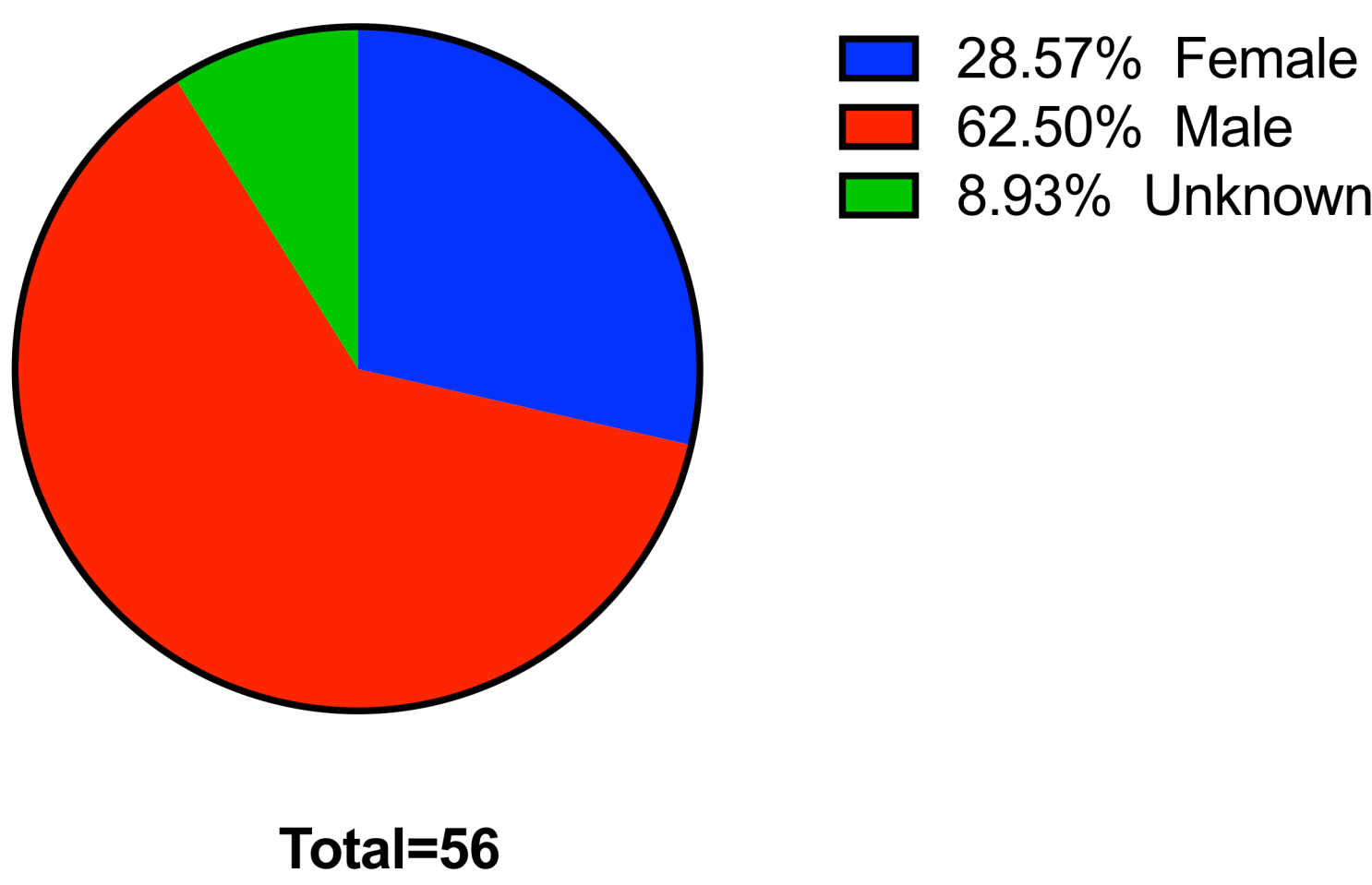
STUDENT DEMOGRAPHICS

6 non-majors & 3 majors' courses, N=107
Mean age: 34 N=56 survey respondents

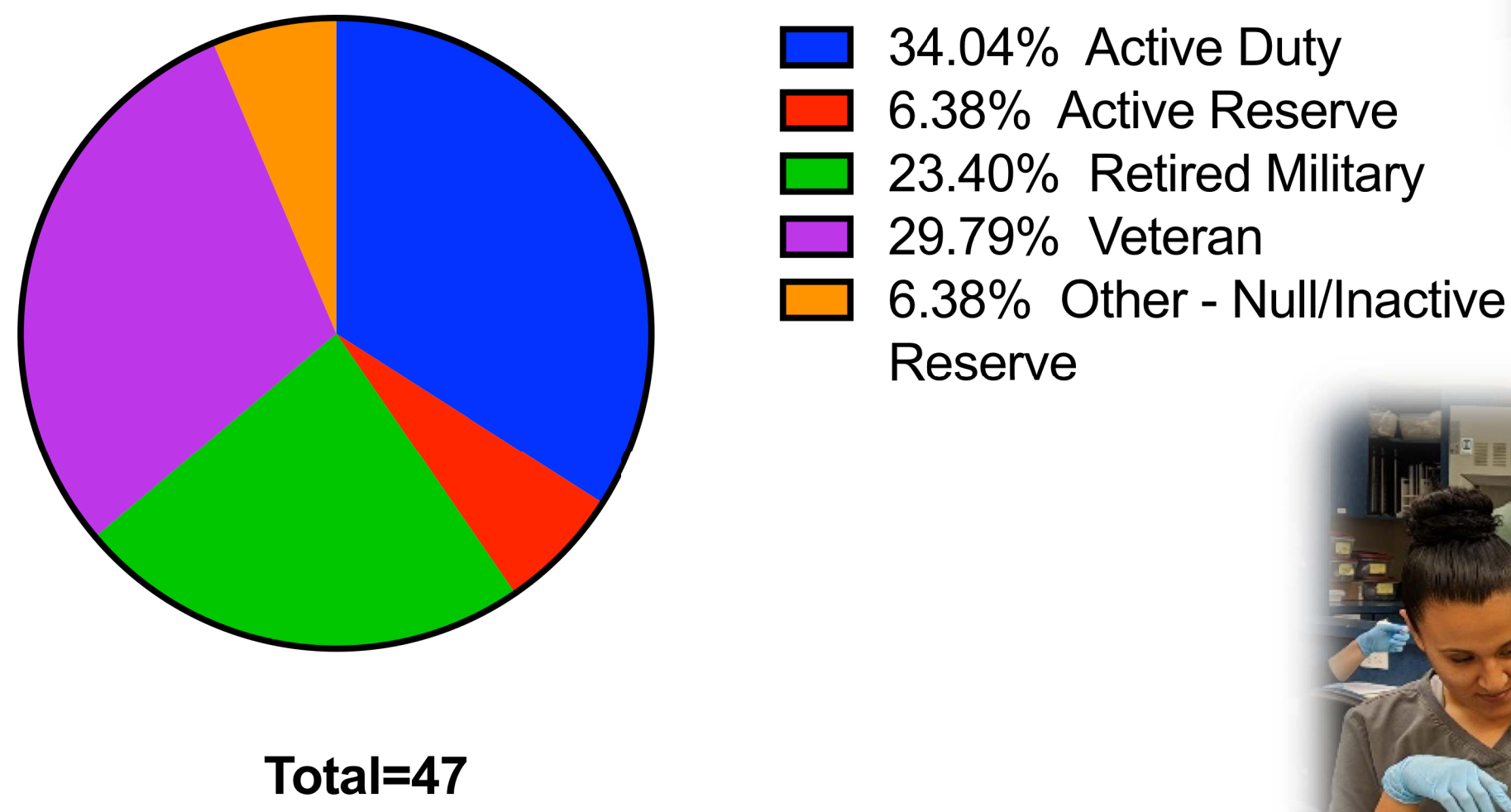
Ethnicity



Gender



Military status



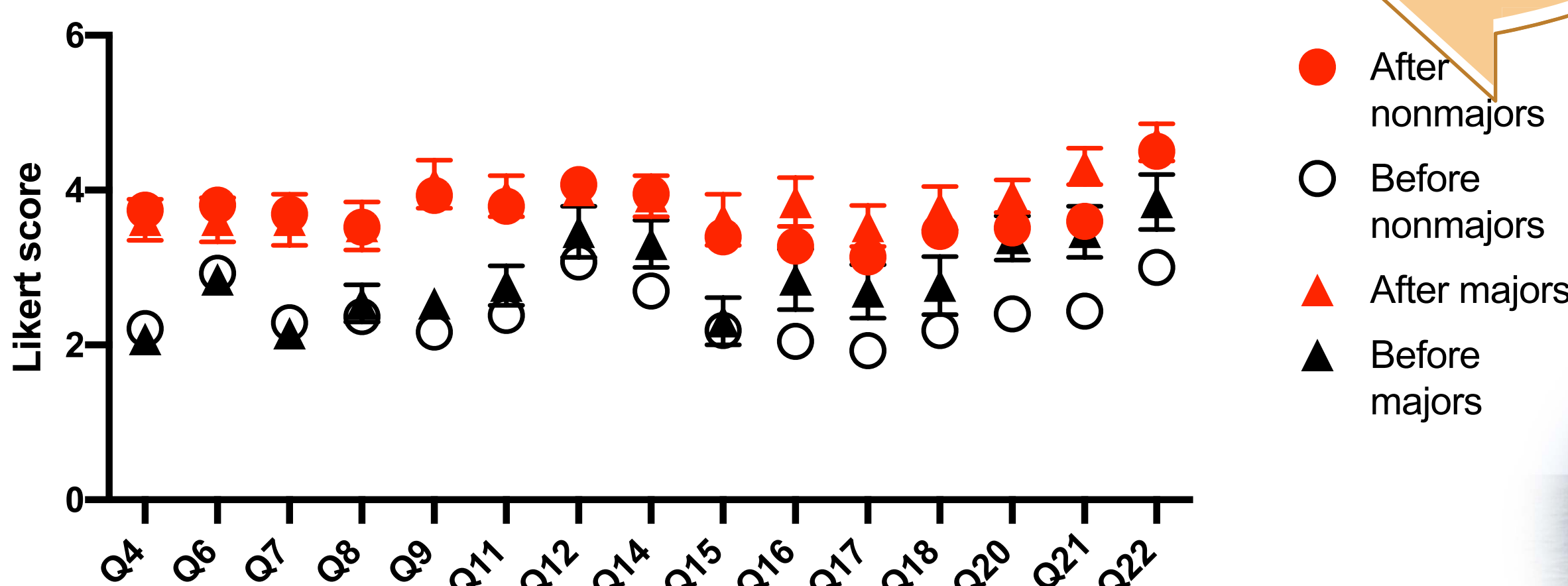
Survey questions

SIO	Q4	Rate your knowledge about the Scripps Institution of Oceanography (SIO)
	Q6	Rate your knowledge about the SIO research projects
	Q7	Rate your knowledge about the methods used by SIO researchers
	Q8	Rate your knowledge about STEM careers
Research at NU	Q9	Rate your knowledge of the plastic research project at National University
	Q11	Rate your competence in laboratory skills
	Q12	Rate your competence in problem solving
Scientific skills (based on CLOs)	Q14	Rate your competence in applying the scientific method, including drawing testable hypotheses from observations and data
	Q15	Rate your competence in techniques such as PCR and gel electrophoresis
	Q16	Rate your competence in compound and dissecting microscopy, including fixing and staining of specimens
	Q17	Rate your competence in classifying organisms according to basic principles of taxonomy, including the use of a taxonomic key
	Q18	Rate your competence in explaining the structure of prokaryotic cells, as well as differences between major groups of prokaryotes
	Q20	Rate your ability to think like a scientist
Interest in science	Q21	Rate your interest in performing scientific research
	Q22	Rate your appreciation of scientific research

RESULTS

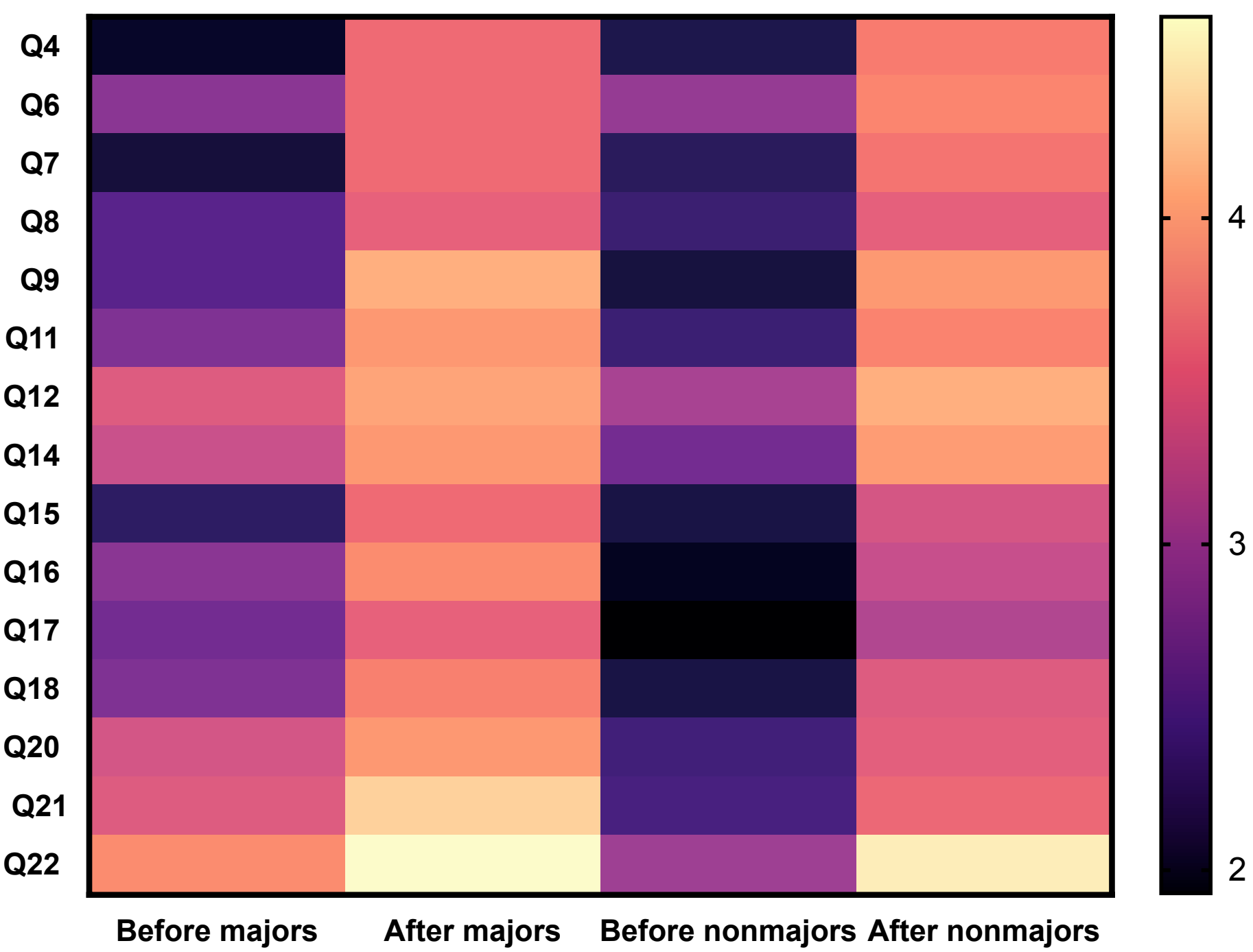
Between November 2018 & February 2020, 6 non majors and 3 majors classes participated in the fieldtrip. A total of 46 nonmajors and 13 majors answered the survey.

Survey results showed a significant difference using 2-way ANOVA for all questions before and after the field trip (nonmajors). Majors improved in questions 4,7, and 9. Student feedback was overwhelmingly positive.



Source of Variation	% of total variation	P value	P value summary
Interaction	2.146	0.1344	ns
Groups	4.825	<0.0001	****
Question	26.05	<0.0001	****

Comparison between majors & non-majors



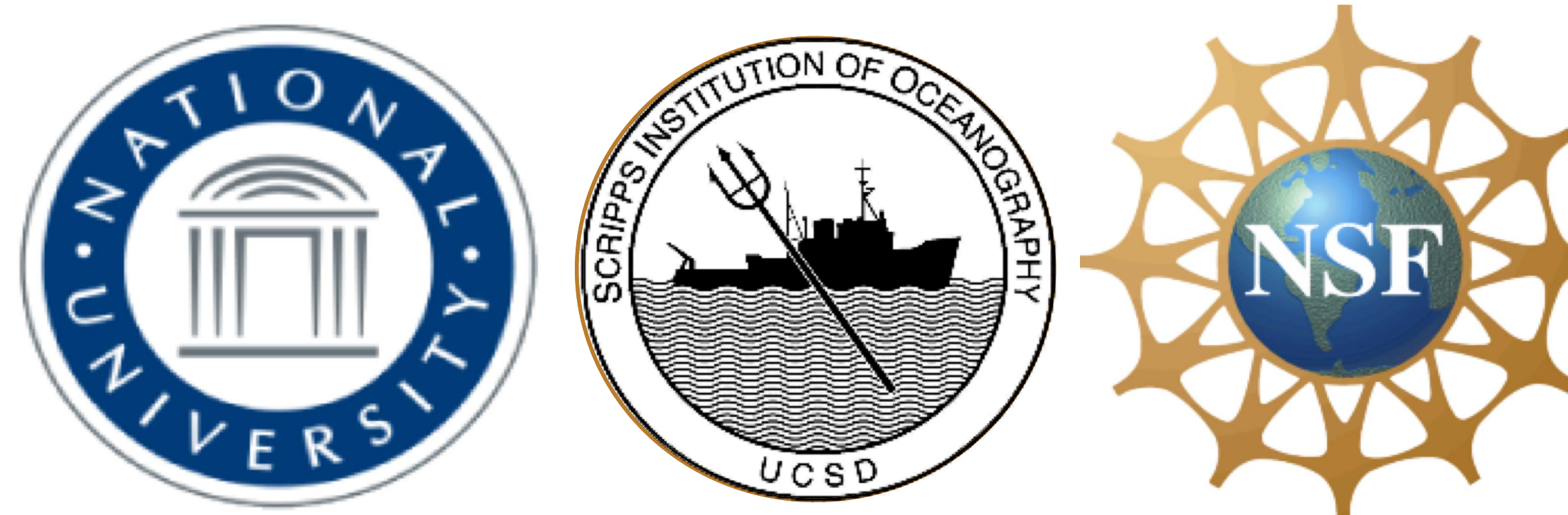
CONCLUSIONS & FUTURE STEPS

CURE has been successfully implemented in non-majors and majors general biology & upper level microbiology lab courses.

Nonmajors students knowledge & perception of STEM careers, ocean plastic research, and laboratory/biology skills was significantly higher after the CURE/field trip experience.

Majors improved significantly in questions related to National University & SIO research.

Possible “spin-off” CUREs include: testing for antibiotic production (microbiology) and chemical characterization (organic chemistry)



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