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STEMSEAS

A Vehicle for the US Academic Fleet to Serve Undergraduates from Diverse Backgrounds

By Sharon K. Cooper and Jonathan C. Lewis

Having the opportunity to go on this trip with STEMSEAS has been the single greatest thing I have ever done. I am so thankful for the opportunity that it has given me. I will never forget it. – STEMSEAS student

The Science, Technology, Engineering, and Math Student Experiences Aboard Ships (STEMSEAS) program began, as many inspiring ideas do, on the back of a napkin. Author Cooper has worked for many years for the International Ocean Discovery Program (IODP) and its School of Rock, which provides teacher professional development workshops on the drillship *JOIDES Resolution* (JR). Author Lewis, an academic, is fortunate to have sailed twice as a School of Rock

instructor on the JR and had been pondering since 2013 how undergraduates might be provided similar opportunities. Having but one JR that is usually in far-off waters presented an obvious challenge. Over coffee in Pittsburgh one day, we discussed the fact that the 19 ships of the University National Oceanographic Laboratories System (UNOLS) often have repositioning transits as well, and these voyages frequently sail out of US ports without full science

parties, meaning there are multiple available berths. Why not use this capacity to provide undergraduates—particularly those from underrepresented groups—the engaging opportunity to climb aboard a research vessel and experience what it's like to conduct research at sea? We are well aware that the geosciences overall, and oceanography in particular, lack diversity (NRC, 2011; NSF, 2011; Slovacek, 2011; Wilson, 2014), and these transits seemed like a perfect opportunity to address this issue in one small corner of our world.

When the National Science Foundation's GEOPATHS solicitation came out in fall of 2015, it was a perfect match with our nascent idea. The NSF program's goals include increasing the number and diversity of students who participate in the geosciences, preparing students for geoscience careers, and contributing to the evidence base for effective student engagement and retention in STEM fields. Our goals for STEMSEAS also aligned perfectly with NSF's long-term goals for improving STEM learning and learning environments, broadening participation and institutional capacity for STEM, and building the STEM professional workforce of tomorrow.

Our successful one-year pilot program allowed for four transits on four different UNOLS vessels and included a total of 36 students. STEMSEAS attracted nearly 900 applications for those 36 spots. We targeted undergraduates at key junctures in their career decision-making, leveraged ship capabilities, established



STEMSEAS cohort on R/V *Sikuliaq*. Mentors from right to left are author Lewis, Karen Thomson, Kris Ludwig, and UMass-Amherst graduate student Raquel Bryant. The group sailed from Seattle, Washington, to Seward, Alaska, in 2016.



STEMSEAS cohort and instructors on the program's inaugural cruise on board R/V *Oceanus*, which sailed from San Diego to Honolulu in May 2016. Instructors Kristen St. John front left and Mark Leckie front right with UMass-Amherst graduate student Rachel Bryant between.

synergistic relationships with ship operators, and delivered content related to the ship tracks. We worked closely with UNOLS staff and ship operations to build relationships based on a shared vision of the UNOLS mission. We also tapped into our network of IODP scientists to make connections to the broader oceanographic community. During our pilot program, the transits were led by experienced scientist-mentors from a variety of institutions (several minority-serving), with diverse scientific areas of expertise. Scientist-mentors included Mark Leckie (University of Massachusetts, Amherst), Kristen St. John (James Madison University), Kaatje Kraft (Whatcom Community College), Steve Pekar (Queens College), Raquel Bryant (University of Massachusetts, Amherst), Karen Thomson (independent consultant), Kris Ludwig (US Geological Survey), Chris Hintz and Carol Pride (both at Savannah State University), and author Jon Lewis (Indiana University of Pennsylvania).

The students came from 17 states

and 29 different colleges (both four-year and two-year institutions). They were 30% African American, 30% Caucasian, 40% Hispanic/Latino, 10% Native American. Many were first-generation college students. These demographics alone seem to have had positive impacts, as two examples of STEMSEAS student comments indicate:

The most surprising thing was how diverse the students and crew were. There were people that looked like me doing the job I wanted to do.

What surprised me about the STEMSEAS program was the diversity of students aboard the vessel. I felt comfortable knowing that several students aboard came from different ethnic backgrounds. In a way, it inspired me to further continue to pursue my dream of becoming a professional scientist.

During the ship transits, students shared experiences in round-the-clock life onboard a research vessel. They gathered geophysical data, performed CTD

casts, collected cores, and picked microfossils to examine under microscopes. They learned basic oceanography, analyzed bathymetry, sampled surface waters while underway, deployed buoys, looked at carbonate chemistry, conducted phytoplankton surveys, and much, much more. Students' schedules also included deliberate time for reflection, journaling, blogging, conducting interviews with crew members, and discussions about options across the range of ocean science careers. During one transit, STEMSEAS shared the space with a group of scientists who were preparing for the next scheduled expedition. Here, they were able to participate in setting up and calibrating scientific equipment. On another transit, they took part in a post-cruise land-based field trip near Anchorage, Alaska, and learned to connect their observations at sea to those on shore.

Research vessels provide an unparalleled floating laboratory environment, where students live and work as real scientists and gain the full experience of being researchers at sea. They also connect with their mentors in ways that are often impossible in a standard college



Graduate Teaching Assistant Raquel Bryant on board *Sikuliaq* in August 2016.

classroom setting. We aim to quantify the impact of such experiences, but initial reactions from students suggest that the impact may well be quite profound:

I was surprised by how my outlook of my future changed in the short two weeks. It made me realize I wanted to change my major and move towards a degree in a physical science, specifically geoscience.

Prior to the experience I was not aware a geology department existed on my campus. I think this program opened the door to a field, and way of life that I didn't think was for me, so for that reason STEMSEAS will always affect me.

And there were unanticipated results—such as the student who marveled at seeing the Milky Way for the very first time, and the poetry they wrote about seasickness and secrets of the seas. As with any group of people living together in a confined space for an extended period of time, the students bonded and became good friends. Their connections to each other—with shared aspirations, goals,

and new experiences—remain one of the most significant things they took away with them. They now have a community with whom to share ideas and questions:

I felt like it opened my eyes to new possibilities I was not aware of. I rekindled my certainty of science and fieldwork. I feel like I have a new set of support in my future endeavors.

I met amazing individuals, made great connections, learned a ton, and am really considering graduate school as a result. Overall, I heavily advocate for this program and see so much potential.

Only time will tell the long-term impacts STEMSEAS had on individual students, but our initial results are promising and interest has been high. STEMSEAS has been funded for at least another three years and has an exciting 2018 schedule planned, including collaborations with other on-coming science parties, groups of graduate students retrieving instruments from the seafloor, and much more. Please follow us

at STEMSEAS.org, and spread the word about the program widely. We have a whole generation of creative problem-solvers to influence! ☑

REFERENCES

- NRC (National Research Council). 2011. *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. The National Academies Press, Washington, DC, 286 pp., <https://doi.org/10.17226/12984>.
- NSF (National Science Foundation). 2011. *Women, Minorities, and Persons with Disabilities in Science and Engineering*. NSF 11-309, National Science Foundation, Arlington, VA, <https://www.nsf.gov/statistics/women>.
- Slovacek, S., A.R. Peterfreund, G.D. Koehn, J.C. Whittinghill, S.T. Kenneth, Y. Rath, and G. Reinke. 2011. Minority students severely underrepresented in science, technology engineering and math. *Journal of STEM Education* 12:1–2.
- Wilson, C. 2014. *Status of the Geosciences Workforce 2014*. American Geosciences Institute, Alexandria, VA.

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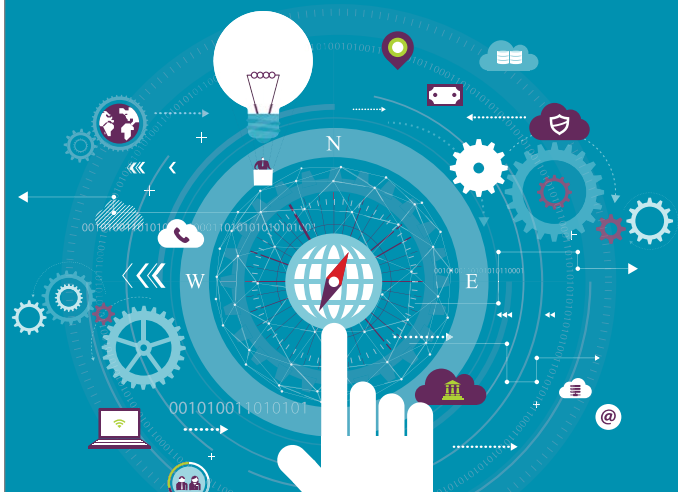
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