Incorporating Deep Sea Science and Underwater Robotics in Low-Income Schools

BY DIEUWERTJE KAST

“We have to add the foam noodles or else it won’t float!” “What if we make the frame of our underwater robot a square, will it still work?... Let’s try it!” Splashes, laughter, scientific thought, “ooh,” and “aahs” were many of the reactions around the pool at a workshop about deep sea science at a Los Angeles elementary school.

JOINT EDUCATIONAL PROJECT’S YOUNG SCIENTISTS PROGRAM (YSP)
The Joint Educational Project’s Young Scientists Program (YSP) works in partnership with six University of Southern California (USC) community schools to engage more than 1,400 low-income elementary school students, 50 Los Angeles United School District (LAUSD) teachers, and six principals through a broad repertoire of science curricula. YSP’s undergraduate teacher’s assistants (TAs) are placed at each school presenting hands-on science labs to fourth and fifth grade classrooms. YSP brings scientific laboratory experiences directly to students and their teachers with the goal of supplementing current science instruction, complimenting LAUSD and state grade level science learning standards, strengthening science literacy, and promoting interest in scientific careers. One of YSP’s primary objectives is to increase science activities for a larger number of neighborhood children as a means to encourage them to consider careers in Science, Technology, Engineering, and Mathematics (STEM), and to apply what they are learning in the classroom to the real world. Additional outcomes include: USC undergraduate students learn how to become successful mentors; gain valuable teaching experience; and learn how to directly respond to the needs of the schools, communities, and families.

YSN & C-DEBI PARTNERED WORKSHOP
The USC Young Scientists Program (YSP) Director, and the National Marine Educators Association (NMEA) Expanded Audience Committee Chair Dieuwertje Kast, hosted a deep

Students enjoy their underwater robot creation while testing the three waterproof motors, but realize it will not sink to the bottom of the pool because they put too many floats onto it. Courtesy of Dieuwertje Kast
sea science workshop for 50 fourth and fifth grade students at Vermont Elementary on November 15, 2016. The event was a collaboration between YSP, Ocean Exploration Trust/Nautilus, Deezmaker, OpenROV, and the Center for Dark Energy Biosphere Investigations (C-DEBI), a National Science Foundation Science and Technology Center) and NMEA. C-DEBI provided YSP with an Educator Small Grant to make the event possible. C-DEBI research focuses on the discovery of the microbial life below the ocean floor, in rocks, and sediments (the deep biosphere). C-DEBI welcomed the proposal that engaged diverse and underserved populations and brought in scientists from ethnic minority backgrounds. The students served are from a school with a 93% free or reduced lunch label—a low-income indicator—and have a student population of 89% Latino and 7% African American. Consequently, this workshop served students that are underrepresented in STEM fields. The workshop was a demonstration of the career opportunities available in deep sea science; and culminated in an inspirational talk from Dr. Gustavo Ramirez, a C-DEBI deep sea scientist. Dr. Ramirez studies microbial life on the deep seafloor, and discussed various careers and disciplines in his field of expertise. The deep sea scientist remarked, “participating in this deep sea workshop has been one of the most fulfilling experiences in my career as an educator. Full student engagement is only possible when young minds, and their burgeoning ideas, are fostered at the K-12 stage. Hands-on experiences—targeting an important demographic in Los Angeles, a global cultural nexus—are a major investment in propelling the human capital of our nation and our collective capacity to face the major STEM-relevant challenges of the 21st century. As a first-generation Hispanic American scientist, I am committed to the dissemination and applied societal impact of STEM sciences and look forward to my continual engagement with inner-city Angelino student cohorts.”

**DEEP SEA STATIONS**

Students learned how scientists explore the deep sea with underwater robots and tools. The workshop was comprised of three different stations: an underwater robot, a robotic arm, and an augmented reality sandbox.

In the first station, students constructed and piloted their own underwater robots using a small obstacle course. A temporary 150-gallon pool was set up at the school for underwater exploration by the robots made with waterproof motors, propellers, and PVC pipe. OpenROV (constructed by Roee Fung) provided a high-tech underwater robot for the event and videoed all of the students’ robotic creations. Students also recreated and used tools that are found on more advanced underwater robots used for scientific research—like a robotic arm—and used straws to make each of the various joints. Afterward, they conducted an experiment to illustrate how the deep sea floor is measured by sonar, and how data collection occurs on the bottom of the ocean. This was done with an augmented reality sandbox, created by Diego Porqueras from Deezmaker.

“Every student I talked to about the workshop had a great time,” said Dawson Ray, a YSP Teaching Assistant. “At the sandbox station, I was able to explain topographical maps effectively—something that trying to teach through pictures in a classroom setting would never achieve. All of the students I talked to the following day said they wished the workshop were a weekly event, which was likely due to the fun, hands-on nature of the stations.”

Ninety-two percent of the students rated the workshop as very good. One student said, “I did not know that there were deep sea animals on the bottom of the ocean or that scientists used underwater robots to “sea” into the sea.”

These experiments resonated among the young future scientists at Vermont Elementary. Andy Lopez, a Vermont student, said excitedly that scientists use robots to see in the deep sea and he now wants to show people how interesting deep sea science is. Another student said that the most interesting thing that she learned was that people used ROVs to detect or rescue things in the deep sea. Another student said, “I learned that scientists use robots to see in the deep sea and I want to learn how to do that.”

The contents of this workshop have been written up into lesson plans and will be distributed as professional development sessions to teachers participating in the program. The C-DEBI educator grant provided the opportunity for the underrepresented students participating in the Young Scientists Program to level the playing field in deep sea STEM fields one workshop at a time.

**DIEUWERTJE J. KAST** is currently the manager of USC’s joint Educational Project’s Science, Technology, Engineering and Math (STEM) programs as well as the director of the Young Scientists Program. Science education is her main passion and her goal is to bring that to the masses and to be able to share her experiences with other STEM educators. She holds a bachelor of science degree in biological sciences from the University of Southern California (USC). There, she also earned her master of science degree in marine environmental biology and her master degree in education. She is currently enrolled in the Doctorate of Education program at USC and will be focusing her research on various aspects of STEM Education.