

MARE Trains Teachers to Become Inquiry-Based Marine Science Education Leaders

"MARE made me a scientist!" Triumphant hollers burst forth from MARE staff members, as our enthusiastic participant, Pothiti Sigalas of Brooklyn, NY, reflected on her changing attitude toward herself as a science educator. We were several days into our MARE Summer Leadership Institute, held this past July 31 through August 8 at the University of California, Santa Cruz. A group of 14 teachers and informal science educators from California, New York, New Jersey, Nevada, and Japan, had come together to learn how to be site leaders for the MARE program.

We had a spectacular week, filled with awe-inspiring field trips and hands-on activities that provided teachers with lots of ocean sciences content, pedagogical approaches, and a strong foundation in scientific thinking and questioning.

Craig Strang, founding director of the MARE program, kicked off the Institute with an interactive lesson, Apples and Oceans, designed to give an understanding of the scale of the planet's ocean and water resources. The next day began with Catherine Halversen, MARE's co-director, leading us through a series of ice cube experiments, with varying levels of support and instruction, to give us a foundation from which to discuss multiple pedagogical

approaches to hands-on science. Teachers continued the discussion about pedagogy as they engaged in a lesson about density currents, which modeled the learning cycle, led by Emily Weiss, the MARE program coordinator. We measured, poured, mixed, dyed, and watched. We practiced the process of inquiry science by asking our own questions as we observed and tried to make sense of what we saw through discussion.

The rest of the day brought observations of crayfish and redwood trees, as we were guided by MARE staff into the practice of "asking the organism". This practice guided us through our many field trips as we learned to ask questions that we could answer through close observations. Everyone was thrilled to "ask the organism" questions like, "Do all of you close up when I touch you?" (to the sea anemone), "How many of you grow in clusters, and how many of you grow alone in this gulch?" (to the redwood trees)

This way of looking at organisms can be transformative for students as they learn to look closely and wonder, just like a scientist.



Next, we prepared for our early morning departure to the tide pools at Natural Bridges State Beach with some sea animal charades and a list of questions to "ask the organisms". The next morning, at 5:30 am, teachers mucked about, scrambling through the sand and over rocks, bravely laying their bodies down on the wet seaweed and getting their eyes down level with the tide pools. As we delighted in the wonders of limpets, snails, and anemones, we talked about how to lead students through the tide pools, *continued on next page...*



MARE Summer Leadership Institute continued...

using the questioning and observing techniques we had been practicing.

Later that day, we began exploring opportunities for authentic literacy integration into science instruction. Teachers looked at a variety of sand samples under microscopes to figure out its composition. When we got to the point of feeling stumped, we eagerly dove into the perfectly timed arrival of books about sand. We were able to use the non-fiction text as a resource that helped us make more informed hypotheses about the origins of our sand sample. We followed this up with a discussion about the importance of creating classrooms where students see books as invaluable resources that can be mined for information to help them make sense of the questions they're grappling with. When used this way, reading is not separate, but a natural, integrated part of the inquiry process. The magic of literacy integration lies in the students having authentic questions and knowing that books can be resources for answering their questions and assisting in their sense-making.



We continued exploring the themes of inquiry, pedagogy, and literacy integration throughout the Institute, as we took on squid dissection, whale-watching, and visiting elephant seals. The MARE staff connected each field trip with one of the habitats covered by the MARE curriculum.

We also visited the Monterey Bay Aquarium and Research Institute, where we were treated to a behind the scenes look at the kinds of questions scientists are trying to answer about the ocean, how they conduct their studies, and the kinds of technology that is being developed every day that make this research possible. We toured their video lab, where scientists were viewing high-definition video footage from their Remotely Operated Vehicles (ROV's) in the Monterey Bay submarine canyon. We met with an engineer who explained how he designed the Autonomous Underwater Vehicles (AUV's) and ROV's to withstand saltwater and high pressure at depth. We learned about how they use these devices to study everything from carbon dioxide in the ocean, to reactions of the deep-sea squid. This field trip gave us an incredible sense of how scientists ask questions and design experiments. It also highlighted the way that scientific inquiry tends to lead to more questions. It provided the perfect lesson for teachers to



understand the never-ending cycle of discovery and inquiry that makes science so compelling.

In addition, we learned about the inextricable interconnection between humans and the ocean (from Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences, K-12). MARE staff brought Ane Carla Rovetta, an artist, storyteller, and naturalist to us for a day of art and storytelling that made the historical and cultural connections between humans and the oceans very real for us all. She led us through sea-animal drawing activities, weaving with cattails and tule grass, and later that night around a campfire, mesmerized our group with Native American stories about the ocean.

I believe we all left with a deeper understanding and appreciation of the ocean, the learning cycle, and the central importance of inquiry.

Noelle Apostol is a new member of the MARE staff. This was her first MARE Leadership Institute.

Photos by Craig Strang, director of MARE