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## **NSTA Reports**

### **Improving Ocean Literacy Through Targeted Professional Development**

**3/5/2012 - NSTA Reports—Kanesa Duncan Seraphin**



Kanesa Duncan Seraphin

The ocean is the defining feature on Earth, and understanding ocean science is essential to the effective management and health of our planet—from global climate change to overfishing. And yet, teachers' discussions in our professional development (PD) workshops in Hawai'i repeatedly focus on the difficulty teachers have in connecting ocean science concepts with classroom learning goals. If teachers in Hawai'i are struggling to make ocean science concepts part of classroom learning, then we have good reason to believe teachers across the nation are struggling as well. Indeed, on the national level, ocean sciences have historically been among the most underrepresented disciplines in K–12 curricula.

The problem, I believe, is that most K–12 teachers lack the content expertise to effectively integrate ocean science into their daily teaching. Our teachers are passionate about the ocean, but their scientific experience is often limited to college classes that lacked applied research or connections to ocean science. Because of this, the volume of content and expertise needed to explore ocean sciences can be overwhelming to classroom teachers. The advent of workshops that showcase cutting-edge ocean research is a positive step toward bringing the excitement of scientific discovery to the classroom and developing personal connections between educators and professional scientists. However, this style of PD often fails to provide thorough connections between ocean science and basic science concepts.

Therefore, I believe that we need additional PD courses that help teachers develop lesson sequences within an ocean context.

As a marine scientist and educator, I see opportunity in the parallels between science literacy and ocean literacy. From physics to chemistry to biology, the understanding of ocean concepts depends on the understanding of basic science principles. For example, the physical separation of water layers in the ocean is tied to density, the acidification of the ocean is related to water chemistry, and the diversity of oceanic organisms results from the biological process of evolution through natural selection. To address these concepts, ocean scientists, science educators, and learning researchers have developed a set of overarching concepts that guide the K–12 teaching and learning of ocean sciences: the Ocean Literacy Essential Principles (OLP). However, the OLP are only the first step in the process of teaching and learning ocean science; the next step is to tie core content to an ocean context in an authentic way.

In pursuing improved ocean science teaching in middle and high schools, the team at the Curriculum Research & Development Group (CRDG) at the University of Hawai'i is developing a series of four PD modules focusing on the physics, chemistry, biology, and ecology of aquatic systems. This approach is designed to provide multiple entry points to ocean science application, which teachers can approach from their respective disciplines. Educational research supports PD that is long-term, focused, and supported by peer mentors. Teachers also need to be teaching during their PD experience—not only because teachers are needed in the classroom, but also because their classroom presence helps teachers to iteratively examine, revise, test, and refine their teaching practice. This allows educators to actively work toward more authentic teaching of ocean science while maintaining classroom curriculum plans. Our PD modules span the course of an academic year, combine in-person and online training, and are embedded within the Teaching Science as Inquiry (TSI) pedagogical framework (originally conceived by Frank Pottenger of CRDG).

By focusing on core science topics, PD can help teachers improve their science content knowledge to become comfortable making connections between their classroom learning goals and the ocean. In addition, PD can help teachers become comfortable with the scientific research process and its relation to inquiry teaching and inquiry process knowledge skills. In our PD, the TSI methodology and the science content are integrated throughout the PD series to help teachers become better communicators, facilitators, and teachers of ocean science.

Preliminary results from our PD series show that teachers have made positive content gains as well as pedagogical gains in their understanding of the practices of science. The discipline-specific activities have provided opportunities for teachers to teach about the ocean using content relevant to their classroom objectives. The TSI framework has helped to free teachers from the misconception that the scientific process is strictly linear and that scientific inquiry needs to be hands-on and open-ended to be authentic. Teachers in our PD are becoming more confident in teaching ocean science, and more comfortable teaching science the way science is practiced—where the classroom becomes a community of researchers guided by the teacher. The ultimate goal is students' improved understanding of ocean science content and students' ability to connect scientific principles to their studies of the ocean.

By approaching topics such as ocean science through core science subjects, I believe we can provide a

critical link for the improvement of ocean and science literacy. This link is vitally important for preparing students to make informed decisions about wise and sustainable practices for us and for our ocean, which covers 70% of the planet and makes Earth habitable. I believe that other disciplines, such as climate literacy, can also benefit from this type of disciplinary approach to PD. 1

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