A New Era of Ocean Exploration Begins

In early summer of 2000, President Clinton directed the Secretary of Commerce to convene a panel of America's finest ocean explorers, scientists and marine educators to develop a national strategy for ocean exploration. This esteemed group delivered a report to the President in fall of 2000 entitled *Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration.* This report included the following four goals:

1) Map the physical and dynamic aspects of ocean regions;
2) Understand ocean dynamics at new scales;
3) Develop new sensors and tools; and
4) Reach out in new ways to stakeholders to improve the literacy of learners of all ages with respect to ocean issues.

Visitors to Sant Ocean Hall explore Earth's tectonic plates on NOAA's Science On a Sphere®. *Credit: John Steiner, Smithsonian Institution. (http://oceanexplorer.noaa.gov)*

In response to the Panels' report, the National Oceanic and Atmospheric Administration (NOAA) created a program in early 2001 to explore Earth's largely unknown ocean for the purpose of discovery and the advancement of knowledge. This program, now part of NOAA's Office of Ocean Exploration and Research (OER), continues to advance NOAA and national goals to better understand the ocean through discovery, research, technology development, outreach and education. An unprecedented 10% of the OER budget is committed to education activities.

Once this guideline was established, education activities of the OER Program were guided by several intentional planning and visioning meetings. In spring of 2001, educators and outreach specialists from NOAA and partner programs came together to imagine or envision what the education program could be. This resulted in support of expedition -education activities beginning with the inaugural expedition "Deep East" in fall 2001. With the addition of a national education director in May 2002, expedition-based lesson plans were introduced. All future

expeditions were explicitly tied to the exploration target of the mission. The education pro-gram made a gigantic leap forward in fall 2002 when over 50 scientists and educators were brought together during a 3-day national education workshop to shape the future of a na-tional Ocean Exploration Education initia-tive.

Some of the suggestions resulted in not only a continuation of expedition-based lesson plans, but the creation of alliance partnerships that host ongoing OER profes-sional development for teachers, an educa-tion listserv, online courses, ocean explorer careers and features for students.

NOAA ship Okeanos Explorer
(http://oceanexplorer.noaa.gov/okeanos/welcome.html)

In addition to this historical account of the development of OER education, the pro-gram is also driven by additional recommendations from the OER Program Strategic Plan, the NOAA Strategic Plan, the National Science Education Standards, the Ocean Literacy Essential Principals and Fundamental Concepts (OLEPs and FCs), evaluations of the first seven years of the "Learning Ocean Science Through Ocean Exploration" teacher professional development workshop series, and the enactment of the Omnibus Public Land Management Act of 2009 (Pub. L. 111-11, Title XII, Subtitle A) which authorizes NOAA's Ocean Exploration and Research Program.

The initial evaluation report provided several recommendations. Among these was a recom-mendation to tie all assessments to the Program Goal and Objectives. As you can see, OER education has completed the entire project development cycle. As this cycle began again and using recommendations from the evaluation report, a goal, objectives, a logic model and an evaluation plan were created for the Professional Development Offerings (PDOs) along with instruments that are being used to collect the data.

The following pages are edited versions of the OER PDO project development cycle which illustrates the progression and connection from a project goal through specific items on an assessment instrument.

NOAA OER Education Mission: Develop and sustain high-quality, effective collaborations between ocean explorers and America's educators in an effort to reach out in new ways to the public to enhance the literacy of learners with respect to ocean issues.

NOAA OER Professional Development Offering (PDO) Goal: The goal of OER Professional Development Offerings, both onsite and online, is to increase professional educator understanding of and appreciation for deep-sea exploration and NOAA's discoveries, and enhance their teaching about ocean science, exploration and discoveries.

NOAA OER PDO Objectives:

1. As a result of providing PDOs, OER will provide effective professional development in support of participants' professional development goals using lessons that are expressly tied to OER's ocean exploration missions, in an effort to bring ocean science and technology into classrooms.

2. As a result of participating in OER PDOs, participants will be introduced to cutting-edge exploration expeditions carried out by expert ocean explorers and technology that will engage them in creative and exciting ways to use the science and technology associated with exploring the world's ocean in their classrooms.

3. As a result of participating in OER PDOs, participants will exhibit an increased awareness of the importance of, and NOAA's role in, ocean exploration.

4. As a result of participating in OER PDOs, participants will exhibit greater confidence in their ability to teach ocean science and deep ocean exploration content to their students.

5. As a result of participating in OER PDOs, participants will become aware of the resources available on the Ocean Explorer Web site.

6. As a result of participating in OER PDOs, participates will be able to effectively use the OER professional development curricula, the OER Web site and other supporting resources in their instruction.

A logic model for all of the objectives for the PDOs is quite large so for o

Inputs	Outputs	
Resources *What we invest*	Activities *What we do*	Participation *Who we reach*
Program Management Staff **Onsite:** **Funds** to support on-site staff time for workshop preparation, presentation materials, equipment, and to recruit participants, and to pay stipends for workshop facilitators, speakers and teachers **Online:** **Funds** to support online host site and management **Ocean Explorers –** Scientists engaged in cutting edge exploration activities **Workshop materials and curricula** **Ocean Explorer Web site** **Trained Facilitators w/instructional kits** **Onsite: Workshop presentation (content and lessons)** **Online: video presentations on key topics and lessons.**	Host two onsite workshops per year at 15 Alliance sites. Host one online PDO/yr During onsite and online workshops Facilitators will: • Introduce content related to ocean exploration and related discoveries. • Lead participants in trying out framework-referenced activities related to presented content. • Discuss the value of ocean exploration. • Familiarize participants to OLEPs and FCs. • Demonstrate and discuss that the ocean is largely unexplored. • Introduce and discuss the technologies employed to explore the deep ocean. • Introduce and explore ways to follow ocean exploration expeditions and discoveries, and access existing, new, or improved OER resources. • Guide reflections with participants about the ways OER tools, materials and resources can fit their curriculum, national and local standards, and address the needs of their students. • Introduce educators to premier ocean scientists/explorers and their research and exploration • Address different teaching and learning preferences and needs by providing a variety of options to engage with the content • Provide PD credit for participation via a certificate.	Onsite: Alliance Partners Grade 6-12 teachers Informal educators Some elementary and pre-service teachers Online: TCOE Grades 6-12 teachers Informal educators Some elementary and pre-service teachers Some general public

ur purposes we will examine part of the logic model for Objective 1.

	Outcomes		
	Short-term *KASA*	Intermediate *Practice*	Long-term *SEE Conditions*
	Knowledge: PDO participants increase their awareness of Ocean Explorer tools and resources PDO participants increase their awareness of the value of ocean exploration. PDO participants increase their awareness of NOAA's role in ocean exploration. Attitudes: PDO participants indicate greater confidence in their ability to teach ocean science content to their students using OER education resources. PDO participants indicate having acquired adequate knowledge to teach ocean science content to their students using OER education resources. Aspirations: PDO participants are motivated to continue professional development through OER PD offerings PDO participants are motivated to incorporate more ocean science and technology into their classroom teaching.	OER has developed and sustains high quality, effective educator professional development workshops, both onsite and online During OER PDOs participants discuss and reflect about how presented content and materials can be adapted to fit the specific needs of their students. During an OER Follow-up PDO participants discuss and reflect about how the workshop content and materials they have used since the Introductory PDO fit their teaching standards and student needs. Once OER PDOs have concluded, OER staff facilitate development of and sustain effective interactions between educators and ocean explorers. After using OER materials, resources, and tools, PDO participants report student excitement about and interest in OER science, discoveries, technologies, tools, and careers. PDO participants continue professional development through additional OER PD offerings. PDO participants share their OER PDO experiences with colleagues. PDO participants indicate the PDOs enabled them to improve their students' learning about ocean science.	Enhanced environmental literacy of the American citizenry. Increased interest in and valuing of ocean discovery.

Partial evaluation plan for objective 1.

Objective 1: As a result of providing PDOs, OER will provide effective professional development in support of particip an effort to bring ocean science and technology into classrooms.

Project Activities	Expected Outcomes	Indicators
Facilitators introduce content re-lated to ocean exploration and re-lated discoveries	Participants indicate greater confidence in their ability to teach ocean science content to their students	Positive responses to PDO assessments
	Participants indicate having acquired adequate knowledge to teach ocean science content to their students	Positive responses to PDO assessments
Facilitators lead participants in try-ing out activities related to pre-sented content	During OER PDOs, participants practice doing ocean science and technology activities Online: Participants are introduced to ocean science and technology activities	PDO Agenda content
Facilitators familiarize participants to OLEPs and FCs and Frameworks	Each presented lesson is aligned with OLEPs and FCs	Presentation content
Facilitators guide reflections with participants about the ways OER tools, materials and resources ad-dress national and local standards	During OER PDOs, participants identify how the lessons, materials and resources presented during workshops meet their local and national Frameworks	Responses during guided reflections
	During OER PDOs, participants discuss and re-flect about how the workshop content and ma-terials they have used since a previous PDO fit their content standards and student needs	Responses during guided reflections

pants' professional development needs using lessons that are expressly tied to OER's ocean exploration missions, in

	Data Collection Methods	Implementation of Assessment
	Survey/questionnaire responses	Pre and post each PDO; Participants
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	Analysis of agenda content and onsite PDO summary forms	Annually; Evaluators and facilitators/OER staff
	Analysis of presentation and PDO summary forms Analysis of workshop content	Annually; Evaluators and facilitators/OER staff
	Responses to onsite facilitator recorded on PDO summary form	During each onsite PDO; participants responses summarized by facilitators
	Responses to facilitator recorded on PDO summary form	During each PDO; participants responses summarized by facilitators

In order to fully assess the outcomes identified in the evaluation plan, several tools were created. These include a Pre/Post Attitude Survey, PDO Summary Form and analysis of workshop content. Below are a few questions from the Summary Form that workshop facilitators complete. These items assess some of the intermediate outcomes identified in the logic model.

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1. Were you able to accomplish the entire PDO agenda?   Yes ____   No ____

    If no, what was omitted?

2. During guided reflections, did PDO participants:

    Indicate they were motivated to incorporate more ocean science into their classroom teaching?   _____ YES   _____ NO
      Notable example(s):

    Understand how the lessons correlate to the OLEPs, the NSES, and the Framework for K-12 Science Education? _____ YES   _____ NO
         Notable example(s):

    Identify how the lessons, materials and resources presented during the workshop meet their local and national standards? _____ YES _____ NO
         Notable example(s):

The following statements are from the Pre/Post PDO Attitude Survey used to assess short-term outcomes identified in the logic model. Responses to these items can range from Strongly Agree - Strongly Disagree.

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1. I know creative and engaging instructional strategies to help my students understand the importance of ocean exploration.
2. I am confident about teaching ocean exploration topics to my students.
3. I am confident in my knowledge of ocean exploration related content.
4. I know about the Ocean Literacy Essential Principles and Fundamental Concepts.
5. I have a good understanding of how the sciences, advanced technologies, mathematics, and engineering are integrated to support ocean exploration.