COSEE Pacific Partnerships Marine Institute Community College Workshops

Summative Evaluation 2009-2012

Prepared by Genevieve Manset, PhD

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Executive Summary

The primary goal of the NSF funded COSEE Pacific Partnerships is to integrate marine research and education for audiences that traditionally have had limited access to an understanding of the ocean. More specifically, their goals are to: 1) increase the role of marine laboratory scientists in education and outreach; 2) increase educational and professional development opportunities for community college (CC) faculty, which in turn will increase the ocean literacy and career potentials of CC students and; 3) increase educational and professional development opportunities in ocean literacy for informal science education professionals and volunteers. In order to address the first two goals, they offered science faculty from community colleges opportunities to participate in specialized courses at marine laboratories with research scientists. Between 2009- 2012, these eight summer institutes included workshops with lectures from ocean research scientist combined with lab and fieldwork activities designed to be applied in the CC classroom. Now in their final year of funding, the COSEE PP requested a summary evaluation of their CC workshops.

Conclusions

- **Participation in the COSEE PP Institutes with their workshop format resulted in quality improvements in ocean science teaching in community colleges**. Most all participants reported an improvement in the quality of their ocean science teaching.

- **Participants increased their confidence in teaching and knowledge of current ocean science research**. Participants reported an increase in their knowledge of ocean science, scientific instruments, and how data are collected and analyzed in ocean science research.

- **Participants changed their ocean science teaching as a result of the workshops, although reports were mixed**. Half of the participants reporting that they added workshop topics to a moderate or large extent to their teaching. Participants also reported developing new courses as a result of the institutes. Changes in teaching tended towards including topics and activities that were more ocean science research focused and in more depth, as well as supporting more student centered, inquiry-based learning.

- **The degree to which workshop topics were added was subject to Community College contextual constraints.** Participants cited a lack of resources, topics too advanced for students' ability level, and inappropriateness for type of courses taught as common reasons not to include workshop topics.

- **For the most part, impact of the workshops did not differ depending on participant characteristics.** The exception to this was that women were in higher agreement than men that the workshops increased their confidence, their knowledge of ocean topics, and how to teach ocean science topics.

- **Action Plans contributed to participants' ocean science teaching.** Action Plan completion supported participants' understanding of workshop ocean science research topics, and were used by participants as a reference when teaching. There was no evidence that Action Plans contributed to the extent in which topics were integrated into courses.

- **Participants perceived that the workshops had a positive impact on student learning and career potential, but more evidence needed**. Participants perceived students to show more interest, and have a greater understanding of ocean science topics. Much of the impact on career potential was attributed to the associated COSEE PP internship program rather than to the workshops directly. A number of faculty felt that they did not have enough evidence to comment on the direct impact on students' learning or careers.

RECOMMENDATIONS

1) *Continue with the current COSEE PP Marine Institute workshop model as a means of improving ocean science instruction in community colleges.*
2) *Reach out to junior and part-time faculty to include more of them in institute, or provide strategies for participants to share information.*
3) *Explicitly address community college constraints that may impede implementation by providing strategies for translating topics for integration into non-major, introductory, or non-marine science courses, addressing lack of resources, and applying to online courses.*
4) *Provide prompts within Action Plans and AP models that would support more high quality, inquiry-based applications of workshop topics and problem-solving that will address constraints to implementation.*
5) *Incorporate more explicitly ocean science career connections for community college students, including those whose are pursuing an Associate's Degree only as well as those who will moving on to 4-year degrees or beyond.*
6) *Incorporate alternative strategies for faculty to assess the impact of workshop activities on their student learning.*

CONTENTS

TABLES

FIGURES

Introduction

The Centers for Ocean Science Education Excellence (COSEE) network was created in 2000 as a part of recommendations made by ocean science educators and scientists to the National Science Foundation (NSF) to create a nationally-coordinated effort to enhance ocean sciences education. The stated goal of the COSEE network is to "increase and enhance collaboration and communications among ocean scientists, educators, and the general public" (Centers for Ocean Sciences Education Excellence (COSEE), 2008-2012). Based at marine laboratories in Oregon, Washington, California, and Hawai'i, COSEE Pacific Partnerships (PP) is a regional collaboration of Western Association of Marine Laboratories, Pacific community colleges, and informal science education institutions (ISEIs).

The primary goal of the NSF funded COSEE Pacific Partnerships is to integrate marine research and education for audiences that traditionally have had limited access to an understanding of the ocean. More specifically, their goals are to: 1) increase the role of marine laboratory scientists in education and outreach; 2) increase educational and professional development opportunities for community college (CC) faculty, which in turn will increase the ocean literacy and career potentials of CC students and; 3) increase educational and professional development opportunities in ocean literacy for informal science education professionals and volunteers. In order to address the first two goals, they offered science faculty from community colleges opportunities to participate in specialized courses at marine laboratories with research scientists. Between 2009-2012, these eight summer institutes included workshops with lectures from ocean research scientists combined with lab and fieldwork activities designed to be applied in the CC classroom. Now in their final year of funding, the COSEE PP requested a summary evaluation of their CC workshops.

Purpose of the Evaluation

The purpose of this summative evaluation is to ascertain whether the COSEE PP workshop format resulted in quality improvements in ocean science teaching in the community colleges. The evaluation was designed to address the following questions:

1) As a result of the workshop(s), did participants create and implement Action Plans (AP) designed to improve the quality of their ocean science instruction?
2) Did participants report an improvement in the quality of their ocean science teaching as a result of the workshop(s)?
3) How were content and ideas from the workshops added to participants' ocean science instruction?
4) Do participants' reports of improvement in the quality of their ocean science teaching as a result of the workshop(s) differ depending on participant characteristics, including experience teaching and educational background?

Evaluation Methodology

A mixed-method approach was used to evaluate the perceived impact of the workshops on the quality of participants' ocean science teaching. Beginning with the collaborative development of a logic model, the evaluator worked with the project team to develop a framework for defining essential features of the workshops and link them to indicators of "quality" as it pertains to ocean science teaching. Using this framework as a guide, a mixed-method approach was used to address questions related to the impact of COSEE PP workshops. Specifically, the evaluator used a convergent mixed-method approach, where both quantitative data and qualitative data are collected concurrently and then merged in the interpretation. The methodology is appropriate in program evaluation as each type of data can be used to validate the other, and combined, can determine progress and outcomes in an open system where, as in this case, a strict experimental design is not feasible or practical.

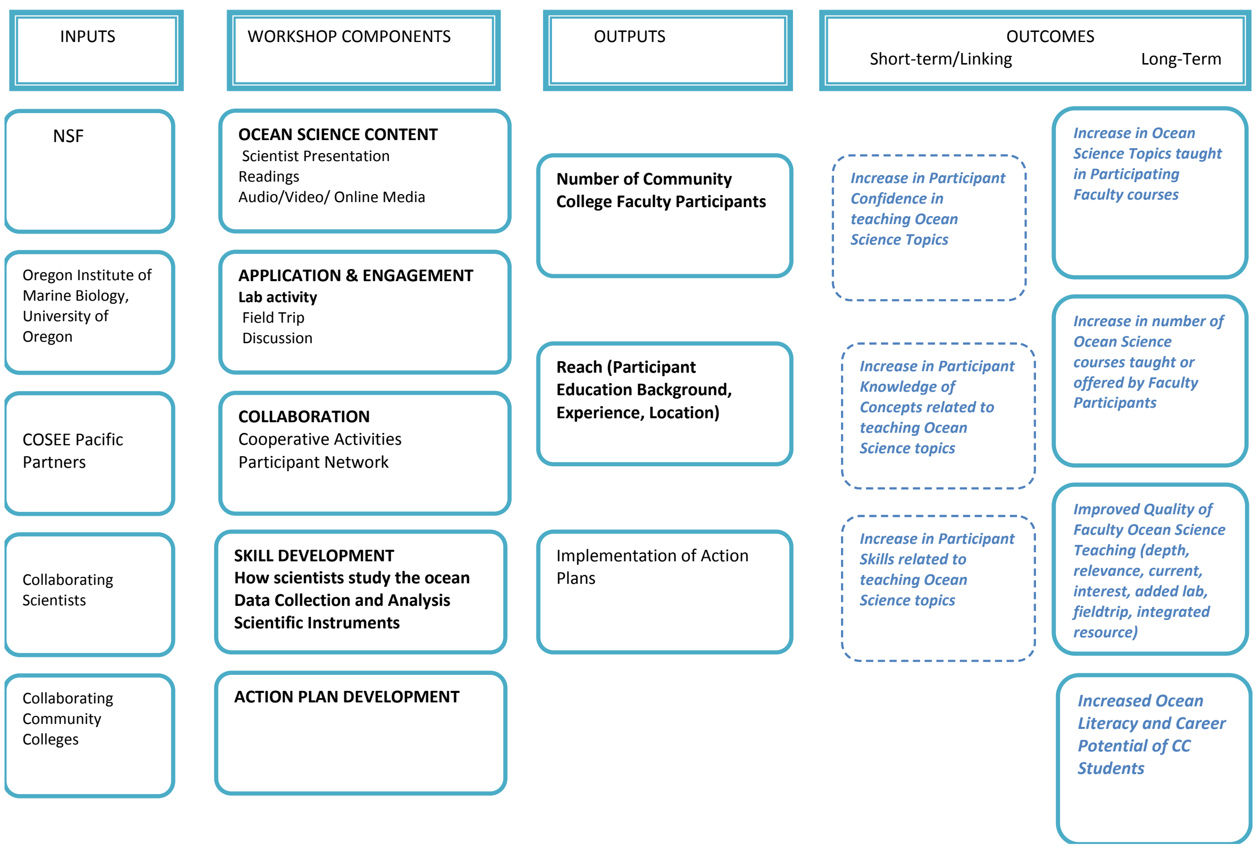

Figure 1 Logic Model for PP Workshop Evaluation

Again with the logic model as a guide and in collaboration with COSEE PP, the evaluator developed a 59 open and closed item online survey, and a 10 item phone interview protocol. All of the 78 participants of the workshops were invited through email to complete the survey and to participate in the phone interviews. In order to ensure high response, participants received two follow-up reminders, and were provided with an incentive to complete surveys with a lottery for an Amazon gift card, and were provided with an Amazon gift card if they complete the interview. Action Plans were coded for content and quality and summarized both qualitatively and quantitatively.

Closed items were summarized using descriptive statistics, and comparative impact was determined using ANOVA, chi-square, and step-wise regression analysis. Open-ended survey items and interview responses were analyzed using a structural coding method with codes evolving from the first pass of responses and then further reviewed for more detailed analysis.

National Context: Ocean Science instruction in Community Colleges

Community Colleges provide a unique and challenging context for the instruction of science courses in general, and for ocean science instruction specifically. Community Colleges serve approximately 45% of all postsecondary students across the country, with only half of those students intending to eventually pursue a 4 year degree (USDOE, NCES, 2008; American Association of Community Colleges, 2013). While Community Colleges are comprehensive places of education, they typically do not have programs that are marine science specific. Of the over 300 listings of marine science and technology programs listed in the *Guide to Marine Science and Technology Programs* (Marine Technology Society, 2008) , only 20 were located at Community Colleges, while others were at 4-year colleges or universities or in technical institutes. Instead, Community Colleges serve some students as a "gateway" to a bachelor's, while others are enrolled in workforce development centers as part of employment partnerships with Community Colleges (Kasper, 2002-03), some of which may have a marine science focus. As a result, ocean science topics are necessarily a part of introductory oceanography or other marine related courses, or integrated as a part of other introductory science courses, such as biology. Of the Associate Degree recipients nationally, 43% were in Liberal Arts/Science, 21% in health professions, and 12% in business (USDOE, NCES, 2008). Common non-AA certificate programs include those in health, business, mechanics, protection services, construction and agriculture.

Students who enroll in CC directly after high school tend to come from lower SES than those in 4 year colleges, and include at a greater rate students from educationally at-risk ethnic minority groups. CC students also tend to have a wider range of ages and greater number of nontraditional or returning students than 4-year programs, with 36% older than 30, and 62% nondependent on parents' income. Students come to CC with a greater range of STEM related abilities than those in 4-year colleges as well. Many are unprepared for postsecondary level courses, with only 38% having completed high school math courses beyond Algebra II, 63% having completed high school science courses beyond General Biology, and 22% requiring a remedial math course.

CC faculty also differs from their 4-year college and university colleagues. Approximately two-thirds are part-time. Half of CC faculty is female, and 85% identify as White. Half of CC instructors have Master's degrees as their terminal degree, while 12% have Doctorates. Teaching is the primary responsibility of Community College instructors, with few required to conduct research, although many do (American Association of Community Colleges, 2013). Community College faculty have higher student contact hours than any other education sector, with an average of 15 teaching hours a week and from 75-150 students at a time. Large teaching loads and underprepared students are cited as the reason for an often heavy reliance on lecture and multiple choice exams (American Association of Community Colleges, 2013). Technology is rapidly changing instruction in high education, with online instruction becoming more and more common.

COSEE PP Institutes

COSEE PP organized a total of 8 institutes located at their partner marine institutes in Oregon, Washington, and Hawai'i: Oregon Institute of Marine Biology (OIMB), Hatfield Marine Science Center (HMSC), Shannon Point Marine Center (SPMC), and Kewalo Marine Laboratory (KML). These 5 day summer institutes were designed around a workshop model, and combined presentations by ocean scientists on their research, lab and field activities that could be used in CC courses, and resources including curriculum materials and online sources that could be used in a community college course. Beginning in 2011, Action Plans (AP) were added to the curriculum in order for participants to consolidate the information from the workshops into plans for implementing topics and materials into their own courses. Examples topics and activities from COSEE PP can be found in Table 1. A complete list of topics can be found in the Appendix.

Participants

A total of 41 (52%) of the 78 COSEE PP Institute participants completed the survey, and 18 (23%) participated in phone interviews. All of the institutes were represented by survey respondents, with an institute response rate ranging from 30%- 93%. All but 2 of the institute,2009 Marine Biology – OIMB and 2010 Climate Change—SPMC , had response rates of 50% or more, indicating that while there could be a bias in the responses toward the later institutes, overall, the survey responses are representative of the workshop participants. All the institutes were represented by the 18 participants interviewed, with a response rate ranging from 18-50% per institute (See Tables 22- 23).

In terms of demographics, the workshop participants were more diverse than the national trends in CC faculty. The majority of survey respondents identified as White (76%) what less than the national average (85%), and there were more female (58%) than male (42%) respondents. Pacific Islander was the second largest participating ethnic group, with 16% of the respondents attending the KWL Hawaiʻi institute from the islands in the Pacific Basin. One participant chose not to reveal their gender, and 3 participants chose not to identify with any race/ethnic group.

Table 1 Example Topics from PP Institute Curriculum

	Example Topics from PP Institute Curriculum		
	Lecture	**Lab/Demonstration**	**Fieldwork**
2009 OIMB	*Dungeness crab research*	*Ocean processes using models*	*Top/bottom of rocks as a model for intermediate disturbance theory Content Coverage: Rocky Shore Biology*
2010 SPMC	*Ocean acidification*	*Ocean acidification lab activities*	*Transect and quadrat sampling (abundance/distribution of sea grasses and Battalaria).*
2010 HMCS	*Microbes in the ocean and the role of SAR*	*ROVS in the Ocean* *Building and testing an ROV*	*Low Tide field trip – the role of abiotic factors in the intertidal zone*
2011 SPMC	*Tidal Power*	*Introduction to NANOOS* *Using real-time ocean observing data*	*Beach Seining at Ship Harbor*
2011 OIMB	*Building a better clam: Ideas for conducting physiology experiments on marine animals in the lab and away from the coast*	*Working with data sets to explore the ocean*	*Low Tide field trip – the role of abiotic factors in the intertidal zone*
2011 HA	*Transmission/harvesting/specificity of symbioses*	*Basic microbial techniques used in coral-microbe investigations.*	-
2012 SPMC	*Larval ecology and plankton dynamics*	*Lab activities for demonstrating ocean currents.*	*Intertidal surveys of Batillaria and marine debris at Padilla Bay*
2012 HA	*"Sequence data, population genetics, F-statistics and how it ties to connectivity theory"*	*Familiarization with different types of tags and telemetry devices-Practical tracking exercise using VHF system."*	-

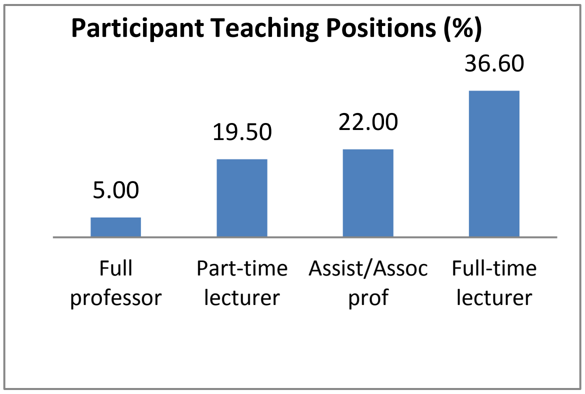

Figure 2 Responding Participants Teaching Positions

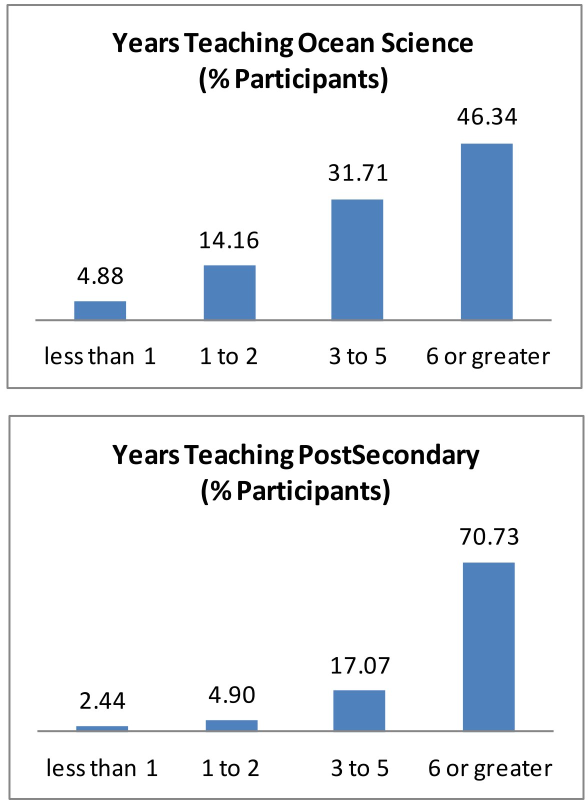

Figure 3 Responding Participants Years Teaching

All participants have advanced degrees in a science field, with by far the majority of degrees in Biology (N=38), with 40% of the participants reporting a master's degree in that area. Degrees in Education (13) and Earth Science (9) follow, with 19% of respondents reporting master's degrees in education and 15% reporting master's degrees in Earth Science. Only 4.9% report a master's degree specifically in Marine Science, and 2 participants with EdD or PhD in Marine Science. In general the participants were veteran instructors, with 71% reporting that they had taught 6 or more years in postsecondary, and 46% teaching ocean science for 6 years or more. Contrary to the national data on CC faculty, most were full-time instructors, with over 80% reporting that they were a assistant to full professor or full-time lecturer or instructor. Participants taught a wide-range of courses, with most of the courses taught either introductory and/or for nonmajors in Biology. These were followed by courses in Marine Biology, Oceanography, and Environmental Science. A small percentage of the courses taught were considered for pre-college students (8%), and for more advanced students (9%). The PP Institutes reached across the contiguous states and out to the Pacific Basin, with approximately half (52%) of the participants from Oregon (N=11) and Washington (N=10). The additional 17% from the Pacific islands (Guam, American Samoa, Mariana, Micronesia) and Hawai'i (N=1) attended the seminars in Hawai'i. Others came from as far as New York, Florida, Virginia, and Texas.

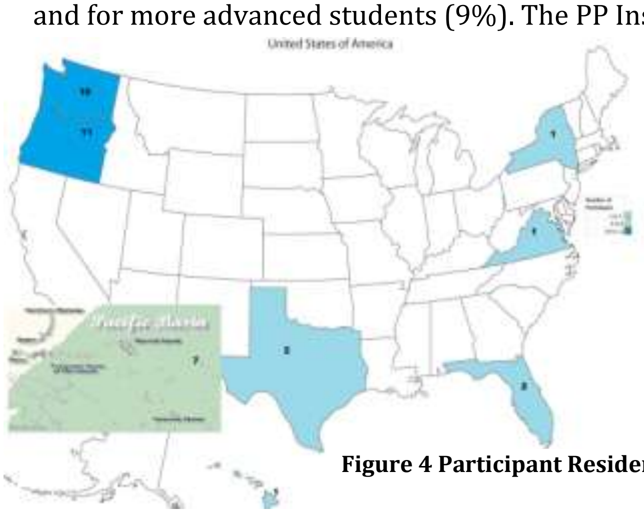

Figure 4 Participant Resident State

Table 2 Types of Courses Taught by Participants in Last 3 years

	Pre-College	Intro	Nonmajors	Adv.	Elective	Total
General Sci	4	3	3	0	1	11
Biology	2	13	15	8	3	41
Marine Biology	1	9	11	2	2	25
Oceanography	1	9	8	2	2	22
Environ. Science	1	6	8	1	3	19
Earth Science	2	5	3	2	1	13
Total	11	45	48	15	12	131
OTHER	12					

Note: "Other" courses Anatomy & Physiology and Chemistry, Aquaculture, Ecology, Ichthyology, Zoology, Energy and Society, General Ecology, Microbiology, Meteorology

SURVEY FINDINGS

IMPROVEMENT IN THE QUALITY OF OCEAN SCIENCE TEACHING

UNDERSTANDING OF OCEAN SCIENCE.

Participants reported that the PP Institutes had a positive impact on their understanding of ocean science topics. Most participants agreed or strongly agreed that as a result of the workshops, they increased the depth of their understanding of ocean science topics (95%) as well as how instruments are used (85%) and data collected (92%) in ocean science research.

UNDERSTANDING OF OCEAN SCIENCE: INTERVIEW FINDINGS

The interviews were consistent with survey findings in that participants reported that their knowledge of ocean science topics increased with their participation in the institutes. Participant backgrounds—their formal science education, the amount of time it had been since they had formally studied ocean science, and their experience teaching ocean science—accounted for differences in how the workshops affected their ocean science knowledge. The workshops added to their depth of knowledge and kept their ocean science knowledge up to date.

Gaps in Instructor Background knowledge

Participant responses often reflected the various interdisciplinary domains in ocean science and their need to keep up with the rapid pace of change in both knowledge and technology. Some had no formal training in any area of marine science, and instead prepared in geology, meteorology, or terrestrial ecology. One participant reported, *" Well I'm a geologist, this was about marine biology and I signed up because I wanted to learn more; a lot of it was way over my head, [use as] background*

Table 3 Participant Reports of Institute Impact on Their Understanding of Ocean Science Topics and Research

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Increased Depth of Understanding	1	0	1	10	28
%	2.5%	0.0%	2.5%	25.0%	70.0%
Increase Understanding: Scientific Instruments	0	0	6	18	16
%	0.0%	0.0%	15.0%	45.0%	40.0%
Increase Understanding How data are collected and analyzed	0	0	3	21	15
%	0.0%	0.0%	7.7%	53.8%	38.5%

in my intro but I can use it as to the ocean course, where maybe only a fifth of it is [marine biology]", while another reported having training, but only as an undergraduate many years before; *"Yes, definitely, I have really limited or formal education [in marine science] , it was good to have refreshers, it was so long ago, it was a stepping stone for me to get back to it [marine science]."* Others noted that they wanted to be better prepared for the courses that they taught, typically because the content in the courses such as Intro to Biology or Intro to Marine Science were so broad. Still, a few of the topics fit specified matched to advanced curricular needs, as expressed by this instructor from one of the Western Pacific Islands who reported that institutes extended his understanding of *"especially genetics, because my background is weak, because I teach fisheries, I was interested in stock assessments; also I work in marine projected areas, genetics are an important way to manage, it was an eye opening, other furnished with a lot of lit review background, if I need to I can go more in depth in the field, …I have background now that can expand on if I go more in depth*."

Extending Background and Applications

Other participants reported that they had a strong background in the field, but had not actually worked with the instruments used for ocean study, and the institutes therefore expanded their understanding of research tools. For instance, one participant reported that, *Yes,[at the workshop], I got familiar with a number of instruments; I was aware of the instruments but have never used them, I have a strong background in Ocean science because of my MA/PhD in that area, but there is a lot that is not new, ...being isolated [in the western Pacific] we don't have access to these tools…"*. Others reported that they felt confident in their background knowledge but unsure how to apply in a CC setting- especially to nonmajors in an introductory course, *"Yes, I had background in marine science before, but [because of the workshop] I saw the direct application, which is not something I thought of in own schooling—ocean acidification and CO2—it allowed me to apply it in a general bio course [for health majors]*." To others, they noted how broad and interdisciplinary the field is, and appreciated the opportunity to add to extend their background, *"Yes [the workshop added to my knowledge], some I knew a bit about, like the eco topics, but the deep sea life was new to me, and a lot was plankton, [new to me, since] I am macro-focused."*

More Current Information

Participants reported an appreciation for how current the information was and their need to keep on top of the technological innovations in the field. One reported, *"I am an oceanographer, but we never had a course for years, in the past it was only taught on coastal colleges, we finally have it going, it has taken 5 years*

QUALITY OF TEACHING.

In addition to their increased understanding, participants reported that participating in the institutes had a positive impact on their teaching of ocean science. Most participants agreed or

Table 4 Participant Reports of Improved Quality of Teaching

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
More Confident Teach	1	0	2	13	24
%	2.5%	0.0%	5.0%	32.5%	60.0%
Improved Quality of Teaching Ocean Science	0	0	6	17	17
%	0.0%	0.0%	14.6%	41.5%	41.5%
How Teach Scientific Inquiry	0	0	13	17	10
%	0.0%	0.0%	32.5%	42.5%	25.0%

strongly agreed that they were more confident teaching ocean science (92%) , and that as a result of participation, the quality of their teaching of ocean science topics improved (83%). A smaller majority agreed or strongly agreed that participation in the workshops led to improved teaching of scientific inquiry (67%).

Changes in Teaching

Besides improved quality, PP Institute Participants also reported changes in their teaching as a result of workshop participation. A majority agreed or strongly agreed that participation in the workshops led to a change in their ocean science teaching (70%), including adding more about scientific inquiry (63%), and scientific instruments used to study the ocean (63%). Half of the participants (49%) added workshop topics to a moderate or large extent.

Table 5 Participant Reported Change in Teaching as Result of Institutes

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Change way Teach	0	2	8	24	6
%	0.0%	4.9%	19.5%	58.5%	14.6%
added more scientific inquiry	0	3	11	22	4
%	0.0%	7.3%	26.8%	53.7%	9.8%
teach more about scientific instruments	0	4	10	24	2
%	0.0%	9.8%	24.4%	58.5%	4.9%

Table 6 Extent Participants Added Workshop Topics

	not at all	to little extent	to some extent	to a moderate extent	to a large extent
Extent Added Workshop Topics	0	2	18	12	7
%	0.0%	5.1%	46.2%	30.8%	17.9%

TYPES OF TEACHING CHANGES

The most commonly reported change instruction had to do with the ocean science content, which participants felt they could discuss in more depth (73%) , the science they discussed was more current (71%), and they were able add resources and media from the workshops into their teaching (49%). Participants felt that they could also make the topics more relevant to students (46%). The changes in teaching also supported inquiry, with students working more often with "real" data (46%) and the addition of labs (42%), and 17% adding more fieldwork. Participants also reported adding changes related to increased student engagement, including increase in cooperative activities (51%) and hands-on activities (46%). Nine participants (22%) reported they were developing a new courses as a result of their participation in the institutes.

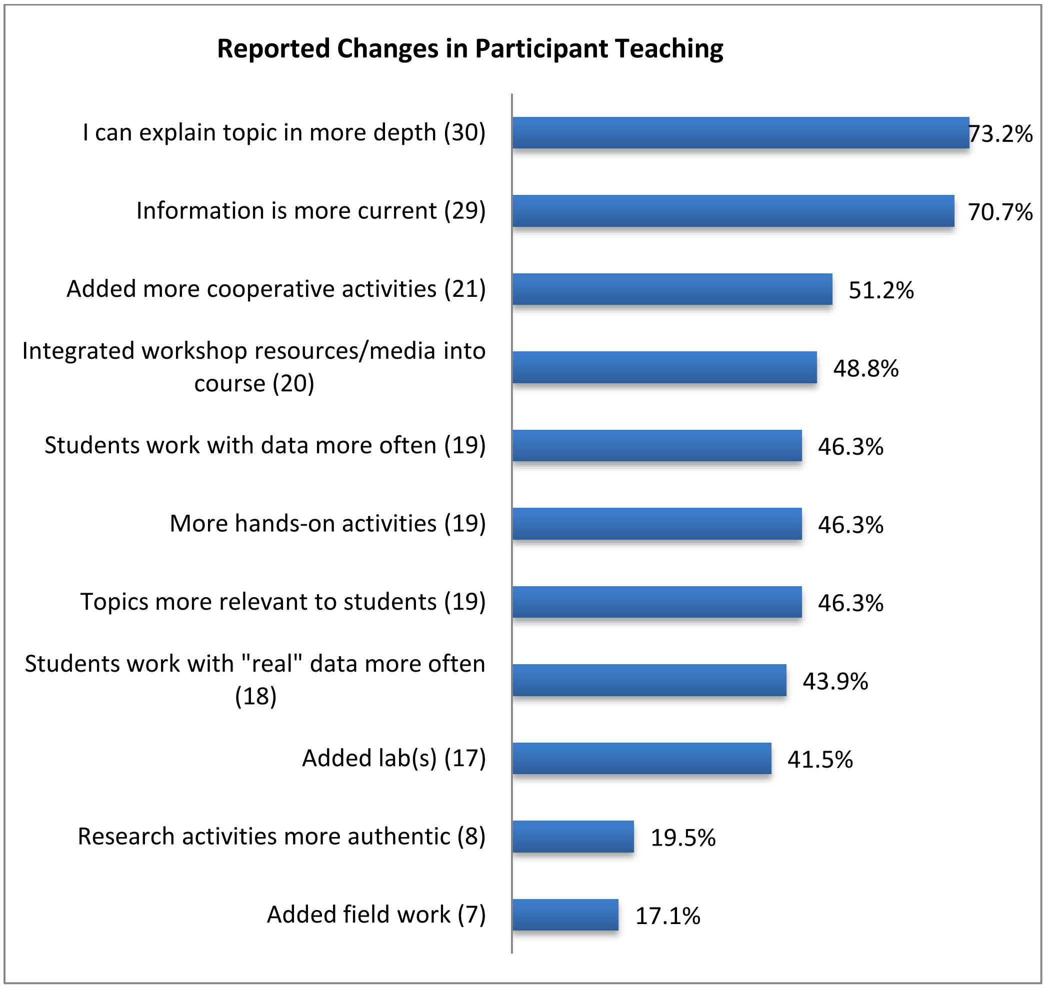

Figure 5 Reported Changed in Participant Teaching

Changes to Ocean Science Related Teaching: Open-Ended Responses

In an open-ended item, participants reported the ways in which their participation in the institutes affected their ocean science related teaching. Participants describe adding ocean science topics or changing the focus of their courses, adding or improving labs and other forms of support for inquiry, and making their courses more relevant, local, or current. Example responses can be found in Table 7.

Table 7 Ways Participating in Institutes Changed Ocean Science Related Teaching (Open-ended Survey Item)

	Ways Participating in Institutes Changed Ocean Science Related Teaching (Open-ended Survey Item) Examples
Added Ocean Science Topics to Course (9)[a]	*I have added the topic of ocean acidification to my environmental science curriculum, and am developing an inquiry-based ocean acidification lab.*
	Discussion and class group projects on current ocean topics.
Increased Lab Work (6)	*I created a climate change lab using temperature, sea level, and ice cover data. I use demonstrations about ocean circulation. I use honey to explain viscosity and perception of small organisms. I show hydrothermal vent videos. I've also used brine shrimp to teach about scientific inquiry, animal behavior, and larval development.*
	Added HOTS data analysis, plating out bacteria, and more microbial info.
Support Inquiry (6)	*I refined field work to include more collection of data and analysis.*
	Added much more student-centered activities and labs that include data collected in the field and interpreted. I also have a deeper understanding of ocean systems and other data collection that is currently available.
Change Focus(3)	*we are in the process of re-vamping our intro biology lab to follow the theme of marine science*
	More of a concentration on ocean acidification. Continued contact with researchers at SPMC.
More Local/Relevant/Current (3)	*Have used the info presented by Taylor Shellfish Farms often. Students relate to what they can eat!*
	topics are more relevant and updated

[a] Indicates number of respondents with comment in this category

Workshop Topics Added

Participants were asked to select topics that had been applied in their teaching since they had participated in the workshop. The most commonly applied topics by institute can be found in Table 6. There is no apparent pattern to the types of topics that were applied, although the topics in the SPMC in 2010 appeared less often applied.

Table 8 Most Frequently Added Workshop Topic by Institute (N=38)

2009 Marine Biology – Oregon Institute of Marine Biology (Total Participants in Institute N=11)	Number Participants Added Workshop Topic
Rocky shore biology	5
Estuarine biodiversity and invasive species	4
Oceanography – density and stratification	4
2010 Oceanography – Hatfield Marine Science Center (Total Participants in Institute N=10)	
Plastics in the ocean	7
Ocean energy (wind, wave, tidal)	6
Ocean observing systems	4
2010 Climate Change and Eutrophication in Coastal and Marine Ecosystems – Shannon Point Marine Center (Total Participants in Institute N=14)	
NANOOS and real time data	2
Ocean acidification	2
Hypoxia	1
2011 Marine Science – Oregon Institute of Marine Biology (Total Participants in Institute N=14)	
Using online datasets to explore the ocean	5
Abiotic factors in the intertidal zone	4
Bioacoustics and sound in the sea	4

Table 8 cont.

2011 Marine and Coastal Science of the Salish Sea – Shannon Point Marine Center (Total Participants in Institute N=14)	
Rocky intertidal (surveys and data analysis)	6
Using online data	5
Intertidal microalgae	5
2011 Microbes in the Sea – University of Hawai'i (Total Participants in Institute N=13)5	
Abundance and diversity of marine microbes	6
Microbial ecology and symbiosis	6
Bioluminescence in the sea	6
2012 Oceanography – Shannon Point Marine Center(Total Participants in Institute N=13)	
Using online data to bring science to the classroom	7
Lab activities for demonstrating ocean currents.	7
Life at low Reynolds numbers	6
2012 Population Linkages in the Pacific Ocean – University of Hawai'i(Total Participants in Institute N=10)	
Law, policy and implications in marine management.	6
Market fish DNA extraction, sequencing, and reading and manipulating sequence data for connectivity analysis	5
Tagging, Telemetry and Biologging methods for studying movements of marine animals	5

Changes to Teaching- Interview Findings

Participants interviewed reported an increased enthusiasm for teaching, more support and opportunity for student inquiry, a change in focus to include more ocean science topics, and the inclusion of more ocean science media, research, and other resources.

Enthusiasm

Those that agreed to that reported an increase in enthusiasm- both theirs and their students, "*…even after 30 yrs you are panicked stricken[teaching a new class]…I'm teaching in a more fun way, because part of my job is to get it going and keep students in the seats…"*. Another reported, "*Yes [it has improved my teaching], I have had positive student evaluations back, and they enjoyed it [the course], more antidotal, they are wanting to learn more…[because of the institute]I am more dynamic teacher.*"

Confidence

Participants also reported an increase in their confidence in teaching ocean science. According to one participant: *"I would say my degree of apprehension came down many percentage points as a result of the workshop, I went there thinking I couldn't do this, and left I can do this."*

Support Inquiry Learning

The participants also felt that the workshops helped them to support inquiry learning. The content in the institutes inspired new or better projects from students, *"I had a student who did a big project on that topic [C02 levels and shellfish] and that would not have happened before…I learned from the student…[the workshops] enhanced my student projects.*" Another felt that it enhanced their already inquiry based approach, "*I come from a background of inquiry based teaching, so I was always and already doing the things or reach questions…it [the institute] strengthened what I already did.*" Often the workshops led to the addition of labs, "*we added the more data collection exploration during our field trip, it is more data driven at now when we go to the coast- in one we use a transect, another we have them compare salinity…*"

Hands-on Activities

Others explained how the workshops added more hands-on and applied activities to the course, "*Yes, all of it, across the board, it has opened my mind to new and exciting techniques in the field…[we now do] interesting hands on activities on diversified topics…[for example]the ROVs –they [the students] deploy them in a swimming pool; when it comes to the filter feeder, they have to do a write up of the scientific method based on how they would they would design a study.*"

New Focus and Perspectives

Some participants reported that the institutes changed the focus of their course and allowed them to add new perspectives on topics. One reported that the institute, "*changed the focus of the class, got me thinking about it [marine topics] in different ways..[I added] food webs, plankton, the bio* *components have changed it in a more ecological way. Another has taken advantage of the online resources, [I use] a lot more of the new technologies…more live links; the old way was more textbook and static now, it [the way I teach] is more dynamic.*" Another reported, "*it [the workshop] allowed me to gel my ideas, allowed to think more deliberately about those topics in those general bio topics; before I may have made passing examples.*"Others commented that their topics were more current and the research more up to date.

Resources

Some participants interviewed described the limited resources and time in CC, and appreciated that there were activities that could be applied cheaply in the classroom. Others at landlocked communities reported that they were given ideas for how to bring the ocean activities to their students without going on a fieldtrip, *"in terms of being creative and getting my students engaged I got good ideas for things to do, we are only an hour from the ocean and a CC with low resources, so it gave me a lot of ideas that I could use far from the ocean.*" A participant cited her five course load, and appreciating "*being able to have the materials given to us and walking us through lesson plans, is easier, very busy, so often being told to teach new courses, so having them given to us [helps].*"

CONSTRAINTS TO CHANGES IN TEACHING

Close to half of the respondents (45%) had topics they were interested in including in their teaching, but found that they could not include them. The most common reasons had to do with the lack of time and resources: either a lack of equipment (27%) or the activity was too time intensive (19%).

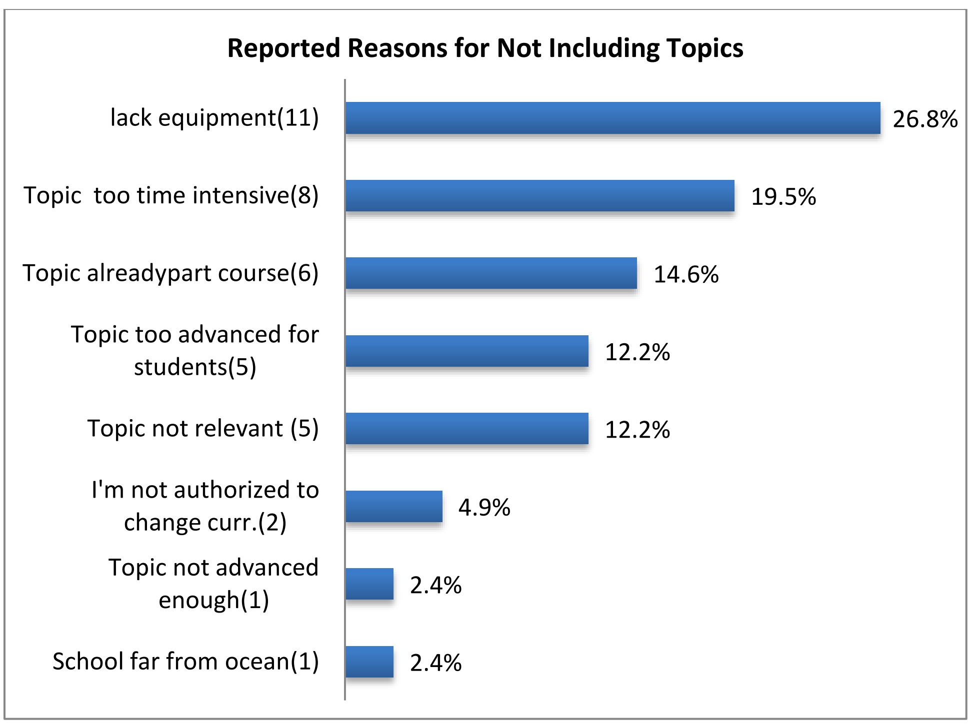

Figure 6 Reasons for Not Including Workshop Topics in Courses

Table 9 Reports of Lack of Equipment as Reason for not Adding Topics by Institute

	Number reports of Lacking Equip/Number reports of Wanting to add topic but could not
2009 OIMB	2/3
2010 SPMC	0/1
2010 HMSC	3/3
2011 SPMC	0/2
2011 OIMB	1/3
2011HA	4/4
2012 SPMC	0/0
2012 HA	1/2

Constraints to Change or Improvement in Teaching: Interview Findings

Some participants that felt there was no change to teaching reported that it was because they were already an inquiry based teacher, and were used to that methodology, for example, *No, I come from a background of inquiry based teaching, so I was always and already doing the things or reach questions, but it strengthened what I already did"*. Others appreciated the information, but the topics and activities were too advanced for their CC students or specific and in depth for the introductory courses they taught. Others reported that they did not have the opportunity to apply it, because they were an administrator and not teaching, they were on sabbatical, or they were teaching online *" limited opportunities to do things in a general ecology course, only offered online."*

Participant Networks

Approximately half of the participants (48.8%) reported communicating with other workshop participants about teaching ocean science to some or a moderate extent, and a majority (61%) agreed or strongly agreed that the COSEE PP network Listserve was useful.

Table 10 Extent Participants Communicate and Use Listserve

	not at all	Little extent	Some extent	moderate extent	Large Extent
Have Communicated with Participants	9	11	16	4	0
%	22.0	26.8	39.0	9.8	0
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Listserve Useful Resource	0	2	13	20	5
N %	0	4.9	31.7	48.8	12.2

Participant Networks: Interview Findings

Isolation and Resources

Participants commented on how isolated they felt since they were one of the few marine science instructors at their CC, and they reported that their colleagues at the institutes provided a valuable network, that could be tapped as a resource, for example, "*also provided me with a network of people that I can call on, and see if it has worked in the classroom, they are always there in a very supported roles, support from the network of people.*"

Perceived Impact on Students

In general, respondents felt that their participation in the workshops had a positive impact on their students, although some felt that they did not have enough evidence to comment on impact on students specifically. The majority of participants agreed or strongly agreed that participation in the workshops led to an increase in students' understanding of ocean science (83%), scientific inquiry (68%), scientific instruments are used in ocean science (54%), and local marine topics (78%). A majority of participants also agreed or strongly agreed that students are more engaged in inquiry activities, including labs (58%) and working with "real' data (57%). A little less than half of participants agreed or strongly agreed that as a result of their participation in workshops, students were more engaged in field work (39%), had a greater career potential (4%), and participated in more internships (41%). Participants also see more student interest in ocean science (61%).

Impact on Students' Learning and Careers: Open-ended Responses

In the open-ended response, participants reported students' expressed interest in and awareness of ocean environmental issues and ocean science careers, while others knew of students changing their majors to one in ocean science. The connection to internships through the program was another way they felt they influenced the learning and career potential of students. Some reported that they had no evidence on the connection between their involvement in the workshop and student learning.

Table 11 Perceived Impact on Student

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Understanding Ocean Sci	0	1	4	23	11
%	0	2.4	9.8	56.1	26.8
Students More Lab	0	1	12	16	8
%	0	2.4	29.3	39.0	19.5
Students More Field Work	0	6	13	11	5
%	0	14.6	31.7	26.8	12.2
Understanding Sci Inquiry	0	2	9	18	10
%	0	4.9	22.0	43.9	24.4
Understanding of Sci Instr	0	3	10	16	6
%	0	7.3	24.4	39.0	14.6
Understanding of local marine	0	3	3	21	11
%	0	7.3	7.3	51.2	26.8
More "real" data.	0	4	10	15	8
%	0	9.8	24.4	36.6	19.5
Interest in ocean science	0	0	12	18	8
%	0	0	29.3	43.9	19.5
Career potential	0	1	20	11	6
%	0	2.4	48.8	26.8	14.6
More Internships	0	5	18	14	3
%	0.0%	12.2%	43.9%	34.1%	7.3%

Table 12 Impact on Students' Learning and Career Prospects: Open-ended Items

	Ways Application of the Workshop(S) Topics and Activities Teaching Affected the Learning And Career Prospects of Students
Change Major(3)	*I teach non-majors, so most students by definition are not interested in pursuing ocean or marine science. However, I know some students who after my Marine Biology class decided that they wanted to pursue marine biology. Yay!*
	A few students have decided to major in oceanography
Internship(4)	*I have referred a couple of my students to the PRIME program although I'm not sure if anything came of it.*
	Some of my students have received COSEE internships and have gained valuable marine science experiences and networks.
Increased Knowledge (2)	*they are now better informed, have current data to back up their studies.*
	The biggest impacts are in the areas of scientific literacy, scientific inquiry and critical thinking
Careers(5)	*I believe my students have a better understanding of the diversity of ocean career prospects.*
	I am able to share a more realistic realm of what is available as a profession, and I am more aware of workshops and student opportunities.
Interest/Awareness	*Also, students have expressed their increased concern about their local, and the global, marine environment.*
	Students should be more aware of climate change impacts on the oceans. Most of them are either pre-med, etc or non-majors (environmental science), so I do not think it has impacted their career prospects.
No Evidence(3)	*I'm not sure of any evidence of this outcome*
	I don't really have a way to measure or assess this.

IMPACT ON STUDENTS' LEARNING AND CAREERS: INTERVIEW FINDINGS

In the interviews, participants reported that they felt that the workshop related expansion and depth in their ocean science knowledge translated into improved student learning. Most of the evidence related to careers had to do with the internship program that they found out about at the workshops. Some were hesitant to comment on direct impact on learning or careers, because they felt they had no way to assess that, and/or their students were nonmajors in introductory courses, and the students had either not decided on a career or they were in a program like health, where ocean science careers were not an issue.

Expansion of Knowledge

Primarily they felt that with the expansion of their knowledge and with students more engaged, students would consequentially increase their learning. One participant reported, "*Yes, don't see* *how it couldn't because we are able to tap into a broader range of topics"* and another, *" Yes, [because] it increased mine [understanding], I have more tools for presenting the information so it gets through to them*" There were some who observed improvements on tests or in student projects, such as this participant, who stated, *"I know from what they put out on their tests…they seemed to be more knowledgeable, because I test them on the curriculum,[as for] long lasting effects I don't know how to follow up."*

More Depth

Some participants responded that they were able to bring more depth to the instruction for students, and therefore the students gained more knowledge. *"…[for] ocean acidification, I spend more time covering the topic; the textbook at the time for the non-major environmental science class literally had two sentences [on the topic], with majors I added in the [ocean acidification] lab, which wasn't doing prior to the workshop."* Another used this analogy *"Yes [increased student understanding], because they would not know about sound in the ocean, the scientific method, the ROVs—they would not know any of that, I created a backbone, this [the institute] put the meat on the backbone."*

Careers

Most of the participants did not have a way of assessing this, since they worked with very beginning students in introductory and/or non-major courses. A few had antidotal information about a student that switched majors or went on to a four year university program in marine science. Some felt that with a stronger science background, that should translate into possibly better careers, such as this participant, who commented, *"Hard to say, hope so, made them more scientifically literate, give them skills for thinking scientifically and critical thinking in general"*, and another, who taught students heading for health related careers, *"For many gen ed bio students it is the last class [the take in science], others are in health, and this is the last chance at a nonhuman classes; it has given them a better understanding of bio overall"*

A number of participants noted how their students received internships through connection with the workshops, which they felt was a stepping stone to careers. One Pacific Basin located instructor noted how important it was to have the link between internship program in Hawai'i, and how that led to students attending the University of Hawai'i, *" indirectly for some of them, top students, best of the best that get into the summer internship programs, have one student who started here who is finishing their masters at Hilo; for some of them the doors open, but it starts with the exposure."* He added that it was important that locals are being trained as marine scientists rather than the old model, where experts would come in to consult. One participant interviewed had her students do a project on ocean science careers. Others felt the constraints of the type of classes they teach, such as this participant, who state, *"not really [affected career potential], because nonmajors, non-lab class; they just learning some [marine science] content, it is too limiting for the context I am in."*

Impact on Quality of Ocean Science Instruction by Participant Characteristics

Surveys were analyzed for the relationship between participant characteristics (gender, race, years teaching ocean science, degree area, and courses teach) completion and impact on their ocean science knowledge, confidence in teaching ocean science content, and changes to their ocean science teaching. Women were in stronger agreement that as a result of the workshops they were more confident adding ocean science topics into their course ($F(1,38)=5.568$, $p=.024$), had a better understanding of teaching about scientific inquiry($F(1,38)= 6.5603$, $p=.015$), the degree they added topics into their courses ($F(1,38)= 4.771$, $p=.035$), and improvement in the quality of their ocean science teaching($F(1,38)= 4.789$, $p=.035$). Participants who identified as White were in stronger agreement that as a result of their participation in the workshops, the quality of their ocean science teaching improved ($F(1,38)= 4.302$, $p=.045$). There were no significant differences by years teaching postsecondary or ocean science, participant degree areas, or the type of courses participants teach on any of these items

Table 13 Impact on CC Knowledge, Confidence, and Teaching Changes by Gender and Race (0=Strongly Disagree, 4=Strongly Agree)

		Gender		Race[a]	
		Female	Male	NonWhite	White
More confident	M	3.74*	3.12	3.18	3.59
	SD	.45	1.05	1.25	.57
	N	23	17	12	29
How Teach Scientific Inquiry	M	3.17*	2.59	2.91	2.93
	SD	.72	.71	.94	.70
	N	23	17	12	29
Extent added topic(s)	M	2.86*	2.29	2.36	2.71
	SD	.94	.59	.92	.81
	N	23	17	12	29
Quality of my teaching	M	3.48*	3.00	2.91	3.41*
	SD	.59	.79	.70	.68
	N	23	17	12	29

Significantly different at * p<.05, **p<.01 [a]Participants who did not identify themselves as White were grouped for this analysis because their numbers by group were relatively small.

ACTION PLANS

Participants completed Action Plans (AP) as a part of half of the 8 institutes, beginning in 2011. After individual workshops, participants were given a template that included questions related to what information they thought was most useful, the possible courses they could apply this information, and ideas they had for applying this information, and additional resources they needed. In the 2012, a question related to why they would teach this to students (learning goals) was added to the template.

In total, 271 Action Plans were included in this analysis, with the greatest proportion generated in SPMC2012 (42.2 %), and then equally among the other three institutes.[1] During the interviews, it was clear that some respondents weren't familiar with the term "Action Plan", and only after prompting, realized that they had completed them. This may have resulted in an under reporting of completion of Action Plans in the survey. Further analysis of AP was based on actual AP submitted.

Table 14 Number of Action Plans by Institute

Row Labels	# Participants Completing Plans	Action Plans	%
OIMB2011	13 (93%)[a]	57	22.71%
SPMC2011	10 (71%)	51	20.32%
HI2012	8 (80%)	37	14.74%
SPMC2012	12 (80%)	106	42.23%
Grand Total	43	251	100.00%

Note: OIMB2009, HMSC2010 SPMC2010 & HI2011 did not include Action Plans as part of their programming. [a]Percent of participants in that institute.

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[1]In an effort to enhance ease of interpretation, workshop topics were consolidated.

The number of AP generated per Workshop Topic ranged from 6- 42, with the greatest number generated under the Workshop Topics *Plankton* (N=42), *Online Data Sources* (N= 40), *Intertidal* (N=38).

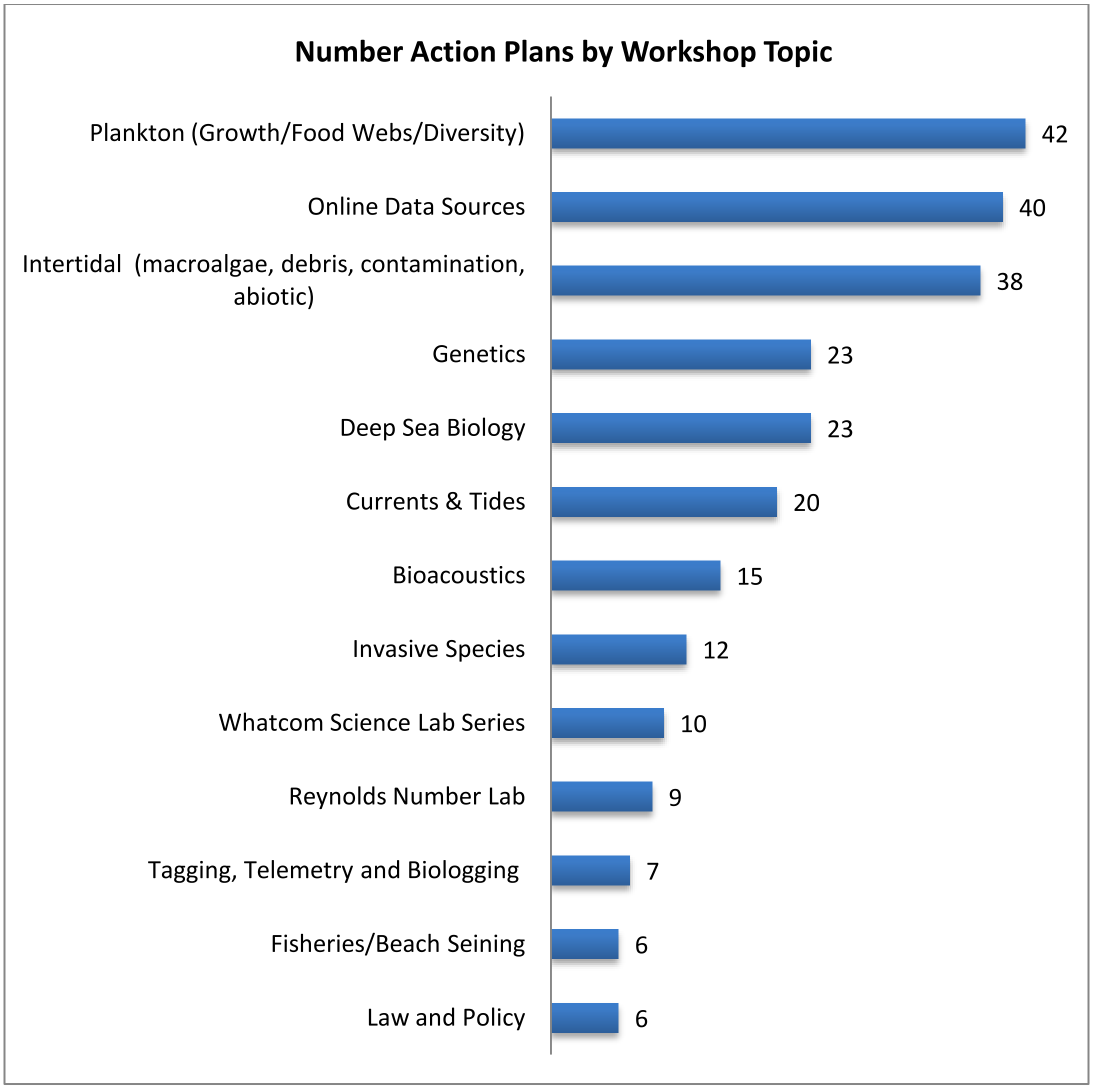

Figure 7 Number of Action Plans by Workshop Topic

Action Plan Content

AP content was summarized based on the planned instructional approach, instructional activities, and proposed ocean science topics. If the content was specified or implied by the context of the workshop topic, it was counted as part of the AP. Many plans contained more than one approach, activity, or ocean science content.

OCEAN SCIENCE CONTENT

AP Ocean Content was divided into six broad domains. Of the AP that specified a content area, the AP most often focused on Marine Fauna (45%), Marine Ecosystems (43%), Marine Physics (32%), and Scientific Process/ History (38%). The AP content directly follow from the workshop topics, so that for instance, in an invasive species workshop, one participant included this in their broad

Table 15 Action Plan Content Codes

Action Plan Content Codes		
Instructional Approach	**Student Activities**	**Ocean Science Content Domains**
Lecture/Demo/Discussion	Data Collection	Marine Physics
Cooperative Teams	Data Analysis	Marine Animals
Lab	Use/Learn About Scientific Instruments	Scientific Process/History
Fieldwork	Use Extant Data Sources	Threats to Marine Environment
New Pedagogical Approach	Review Research	Marine Flora

Marine Ecosystem AP: *"invasive species games, add more mud flat ecology to marine bio, video, case study, mud flat sampling to rocky intertidal… in order for students to develop… appreciation the complexity of invasive species topic, review basic ecological principles"*.

APs that included content in the Marine Fauna domain focused on topics as varied as zooplankton, fish, or marine mammals, although the latter was less common and more typically related to bioacoustics or migration. For instance, one participant planned to "*Use concept of quantitative sampling in Fish/Fisheries module; Seine a local river/intertidal, ID and count catch, measure total length. Analyze data to show animals are highly variable in size, most have seasonal reproductive patterns, and age structure.*" AP that focused on currents, weather, or ocean chemistry were categorized under the Marine Physics, for example one participant proposed "*…short demonstrations would be a great way to introduce a topic about weather in the PNW and how it affects the climate here which in turn affects the biotic components. I would do this during lecture and have students draw their results…Start marine pollution sampling somewhere in Bellingham!..Students would learn the connection between current/weather patterns and the flora and fauna that is found in the PNW.*" APs in the Marine Flora domain included content primarily focused on algae or phytoplankton.

"I'LL DO A LAB TO SHOW THEM HOW ATMOSPHERIC CIRCULATION WORKS, HOW WINDS AFFECT THE OCEAN, WIND DRIVEN CURRENTS & SUBTROPICAL GYRO, HEAT MOVING AROUND THE GLOBE BY OCEAN CURRENTS, THEN TALK ABOUT PLASTICS & SHOW THEM THE VIDEO, HAVE THEM DO A SIMULATION TO DETERMINE WHERE PLASTICS/GARBAGE GETS TRANSPORTED"

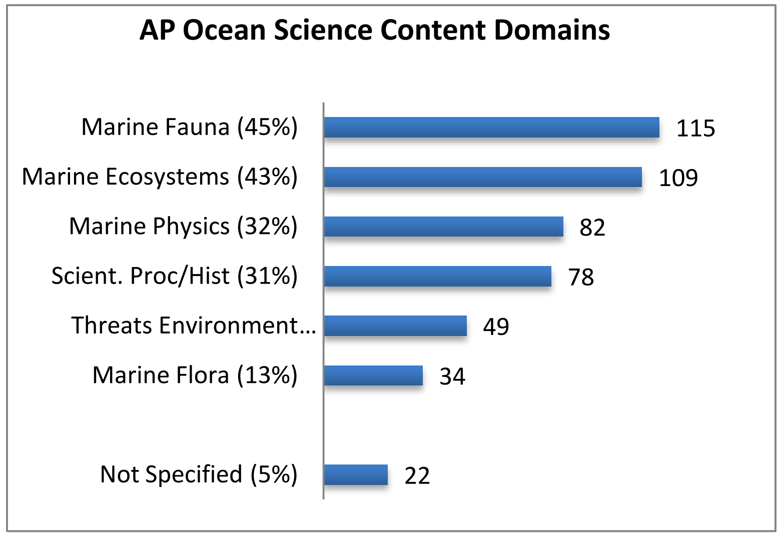

Figure 8 AP Ocean Science Content Domains

APs also included content related either to the history of science or to the learning more about the scientific process or techniques. Some participants planned to have students apply scientific formulas that are commonly used in ocean science, or to research the history of research vessels. The Reynolds Number Lab was one example of a workshop topic that led to applications of a scientific tool, in this case a formula. One AP included the application of math in a section on "scaling": *"when teaching my section on scaling this would be another place to have my biology majors do math, calculate re# & viscosity, scaling w/length, linearly, create similar re#s to directly model feeding in copepod/ barnacles."*

AP Instructional Approach.

A meaningful proportion of the APs included alternatives to lecture/discussion (35%), by proposing to include either a lab (39%) or fieldwork (22%). The labs proposed reflected workshop topics or activities. Some, for instance, focused on examining currents, while others the physiological change in organisms, such as using a *"clam filter feeding activity/lab to explore physiological responses to abiotic stressor*". A number of the labs were based in an extant, online data base, such as this one, where students would participate in a *"lab comparing krill to penguin populations or some other variable comparison."* Since the AP were designed for the AP author only, often a participant simply reported that they would "*Use [workshop] exercise as is*", while others provided specific detail in their plans, with their specific course or students in mind. A large proportion of AP instruction activities were alternatives to Lecture, and were inquiry- based, including either a lab (39%), fieldwork (22%), or both.

"PROVIDE STUDENTS W/FREQUENCY DATA SETS AND HAVE THEM SOLVE PROBLEMS TO DETERMINE CHARACTERISTICS LIKE PREY LENGTH, SOUND SPEED; CONSTRUCT HYDROPHONE AND CONDUCT EXPERIMENTS IN LAB, COMPARE TO FIELD DATA; LISTEN TO VARIETY OF VOCALIZATIONS AND DEVELOP CODE.

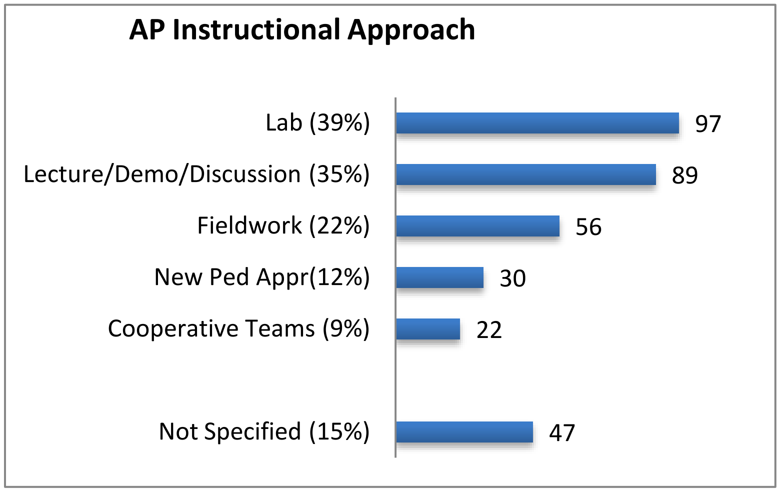

Figure 9 AP Instructional Approach

Other participants planned to get their students out into the field to collect and often analyze data, for example an *"intertidal survey--do just like we did, with other pairs of organisms or with 1 organism and a location (on top/below)*." Some found that it was a new pedagogical approach, modeled in the workshop, that they wanted to bring into their classes, whether it was brainstorming, concept mapping, or other types of student-centered interaction, such as: "*She discussed a group activity on sampling that I will use in small student groups. I think it was termed "think/Pair/share.*" While only a small proportion of the AP included the use some form of cooperative teams, it is possible that many of the proposed activities would require teamwork (such as in the lab and field) but that information was not made explicit.

AP STUDENT ACTIVITIES

Consistent with the findings on instructional approach, many of the participants planned for their students to be actively engaged with data, either through data collection (41%), analysis (46%), or using an extant data source (24%). Many of the AP included plans for adapting the data related activities modeled in the workshop, for example, this participant suggested: " *a transect at the beach and bring back the data for them to analyze. If I do get to take a group to the coast, we will most certainly do a transect – possibly looking for bean clams. Barbara explained a good process for* *beaches where you use a PVD pipe with cap. Drill a hole so air can escape, and twist it down into the sand about 10cm. Analyze the 'core sample.' "*

The online data workshops appeared to open up possibilities for participants whose students didn't have access to labs or the field. The Deep Sea workshop, for instance, produced this AP: *"Compare deep sea fishery impacts with offshore fishery impacts; Lab: compare energy budgets of shallow and deep sea corals; Lab: topographical data sets to predict locations of deep sea coral, impacts of industries in those areas; Envir. Impact statement."* The following AP was developed in response to the Online Data Sets workshop, … *ContrastIssiss. R. versus Columbia R. parameters (ca, sediment, alkalinity); Use NWIS water data website map of US stations to see which areas are above/below average; Contrast a river that is near the cascades vs. on the coast, look at response to rain."* Less often did AP include students involved in the more traditional activity of reviewing existing research (11%), and often this activity was paired with actual engagement with data.

"…A FINAL PROJECT THAT WILL INVOLVE A FIELD TRIP TO SOUTH SLOUGH, WHERE STUDENT CAN OBSERVE THE ESTUARY AND MAKE PREDICTIONS ABOUT HOW ENVIRONMENTAL CONDITIONS MIGHT VARY IN DIFFERENT PARTS OF THE BAY (AS WELL AS THOUGH TIME). THEY WILL THEN TEST THESE PREDICTIONS USING DATA FROM NERRS."

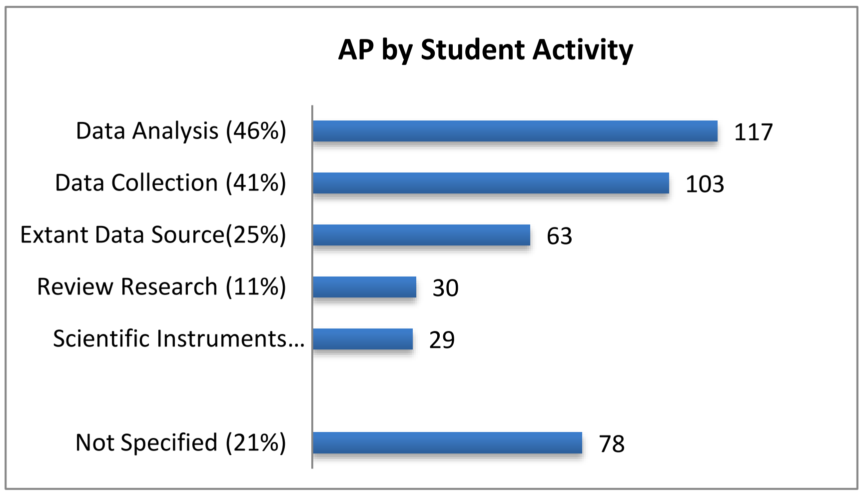

Figure 10 AP Student Activities

Quality of Action Plans

There is growing evidence in support of the efficacy of student-centered, inquiry models of instruction in learning science concepts, specifically, a systematic instructional model that incorporates elements of the inquiry cycle (R.W. Bybee, 2006). Drawing on this assumption, an Action Plan Quality Index (APQI) was developed by the evaluator in order to quantify the quality of the APs. The APQI consists of a composite of AP comprehensiveness (concept/goal, process, materials, possible score 0-3) and the inclusiveness of inquiry cycle components (engage, explore, explain/predict/apply (possible score 0-3). AP were coded for each of the comprehensiveness and inquiry elements that were evident in the AP, and then totaled for the APQI. Using the APQI, APs were also categorized as High quality (APQI >4), Average Quality (APQI 2-4), or Low Quality (APQI <2). Intra-rater reliability for the Action Plan Index for 5% of the plans was moderate (r = .708).

Table 16 APQI: Example Content

APQI Score	Example AP Content
6	"Compare deep sea fishery impacts with offshore fishery impacts; Lab: compare energy budgets of shallow and deep sea corals; Lab: topographical data sets to predict locations of deep sea coral, impacts of industries in those areas; Envir. Impact statement"
3	"Have students work with data sets, specifically to examine primary productivity, O2 levels, and hypoxia"
1	"Field trips; Photos for lab activities; Possible lab activities"

While over half (53.8%) of the APQI that could be characterized as "High Quality" there was a lot of variability in the APQI. The average APQI quality index was 3.86, with the average APQI score of APs in SPMC 20ll (M= 2.90) significantly lower than those in OIMB2011 (M=3.86) and SPMC2012 (M= 3.95).

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Table 17 AP Quality Index by Institute

		Institute				
		HI2012	OIMB2011	SPMC2011	SPMC2012	Total
Total Comp. Score	M	1.92	2.35	2.10	2.29	2.17
	SD	0.83	0.90	1.01	0.87	0.90
	N	37	57	51	106	251
Total Inquiry	M	1.51	1.60	0.80	1.57	1.37
	SD	1.46	1.10	1.00	1.34	1.23
	N	37	57	51	106	251
AP Quality Index	M	3.43	3.95	2.90[a]	3.86	3.54
	SD	2.15	1.61	1.72	1.97	1.86
	N	37	57	51	106	251

[a] *Significantly different from OIMB2011 & SPMC2012 at p< .01*

Table 18 APQI by Topic

			AP Quality Index		
Institute	Topic		Low APQI	Ave APQI	High APQI
OIMB2011	Bioacoustics	N	1	4	10
		%	6.7%	26.7%	66.7%
	Deep Sea Biology	N	2	4	7
		%	15.4%	30.8%	53.8%
	Intertidal (microalgae, debris, contam., abiotic)	N	3	3	9
		%	20.0%	20.0%	60.0%
	Online Data Sources	N	1	1	12
		%	7.1%	7.1%	85.7%
SPMC2011	Currents & Tides	N	4	5	2
		%	36.4%	45.5%	18.2%
	Fisheries/Beach Seining	N	1	2	3
		%	16.7%	33.3%	50.0%
	Intertidal (microalgae, debris, contami., abiotic)	N	2	8	5
		%	13.3%	53.3%	33.3%
	Online Data Sources	N	2	3	4
		%	22.2%	33.3%	44.4%
	Whatcom Science Lab Series	N	3	4	3
		%	30.0%	40.0%	30.0%

Table 17 cont.

			AP Quality Index		
Institute	Topic		Low APQI	Ave APQI	High APQI
SPMC2012	Currents & Tides	N	2	3	3
		%	25.0%	37.5%	37.5%
	Deep Sea Biology	N	1	6	3
		%	10.0%	60.0%	30.0%
	Intertidal (microalgae, debris, contam, abiotic)	N	1	1	6
		%	12.5%	12.5%	75.0%
	Invasive Species	N	5	3	4
		%	41.7%	25.0%	33.3%
	Online Data Sources	N	3	4	10
		%	17.6%	23.5%	58.8%
	Plankton (Growth/Food Webs/Diversity)	N	6	9	27
		%	14.3%	21.4%	64.3%
	Reynolds Number Lab	N	0	1	8
		%	0.0%	11.1%	88.9%
HI2012	Currents & Tides	N	0	1	0
		%	0.0%	100.0%	0.0%
	Genetics	N	8	2	13
		%	34.8%	8.7%	56.5%
	Law and Policy	N	3	2	1
		%	50.0%	33.3%	16.7%
	Tagging, Telemetry and Biologging	N	1	1	5
		%	14.3%	14.3%	71.4%

Quality of Action Plans by Participant Characteristics

The relationship between quality of AP differed depending on participant characteristics was examined using chi-square analysis, with APQI categorized as high, average, and low. Differences in scores by gender, race, years teaching ocean science, and degree type were not found to be statistically significant.

Reported Use and Helpfulness of Action Plans

Approximately half of the respondents who indicated they had completed an Action Plan reported that they found the AP somewhat or very helpful (51%), and reported that they used them to some or a moderate extent (53%).

Table 19 Survey Participant Reports of Use and Helpfulness of Action Plans (N=27)

	Extent Used Action Plans				
	not at all	to little extent	to some extent	to a moderate extent	to large extent
Extent Use	4	1	14	8	0
%	9.8%	2.4%	34.1%	19.5%	0%

	Helpfulness of Action Plans				
	Not at all Helpful	Not so helpful	Neither	Somewhat helpful	Very helpful
How Helpful	0	3	3	12	9
%	0%	7.3%	7.3%	29.3%	22.0%

Implementation of Action Plans: Open-Ended Items

Respondents reported using the AP as a reference or guide for applying AP information in their courses. Others reported using the AP as a way to process the information and developing activities for their courses. Additional comments referred to why they did not find the AP useful, and included working in a nonteaching administrative position, not having time or resources to apply the action plan activities, or not having an opportunity to teach ocean science topics yet. Table 19 provides example of each of these.

Table 20 Ways Participants Used Action Plans: Open-ended Items

	How Used Action Plans
Reference (7)[a]	*At the start of the quarter, I reviewed my action plans to recall the new ideas I had for how to incorporate new material into the course.*
	I have used them and plan to use them to think about the types of topics and associated activities I could do in class. So they really help me to focus and to plan.
Guide for Application of Workshop Topics(6)	*Integrated what I learned in the workshop into my teaching.*
	Introduced group projects for ocean science topics like plastic in the ocean, ocean acidification, etc...
Process Information (3)	*It made me stop and think of HOW to implement the information right then when it was fresh in my mind so that later I just had to review my notes, or the ideas were already fleshing out in my mind.*
	The action plan was very useful in processing the material from the workshop and helping focus on application (rather than just enjoying participating!). The process was more important to me than actually using them. By the time I was teaching the course, it had been awhile so my thoughts on how to use things had already evolved. However, the process is what helped make the ideas stick and to see the connections between presentation and the reality of implementation.
Develop New Lessons/Activities (3)	*Develop activities that actively engage student in current evaluation of seafood markets and overfishing. Pollution and acidification activities also included.*
	I developed a lab as a result

[a] Number of respondents who answered this question

ACTION PLANS- INTERVIEW FINDINGS

Of the participants that were interviewed and who had completed Action Plans, a majority found them to be useful as a way to organize their thinking on the workshop topics, or to use as reference later as they taught.

AP as Way to Organize and Focus Thinking

Primarily they found the institutes packed with so many new ideas and activities that that the AP helped them to organize their thoughts about how they may apply them. One appreciated the prompt to write down her thoughts, "*I don't want to use the word force, but it gave a good running start on what the ideas were and how I would use them in the classroom."* Others liked having to bridge the institutes with their own teaching, *"yes, [the APs] were overwhelming useful…you learn so much and see so much, but the days are full- so having time to think about how to incorporate them into class is good."*

AP as Reference

Other participants used them as a reference when they started teaching, as one concluded, *"…they [APs] were very useful, and it isn't something I like to do, but to be forced to write down ideas at the time it helps to concretize them, and it made me think…I could go back to my notes and organize my thoughts at the time…a good reference."*

ACTION PLAN COMPLETION AND QUALITY AND CHANGES IN OCEAN SCIENCE INSTRUCTION

Surveys were analyzed for the relationship between Action Plan completion and impact on CC instructor ocean science knowledge, confidence in teaching ocean science content, and changes to their ocean science teaching. There was a significant, positive relationship between AP Completion and an increase in confidence in ocean science teaching (F (1,37) = 9.727, p = .004), increased understanding of how scientific instruments are used in ocean science research (F (1,38)=7.926, p=.01), and increased understanding of how data are collected and analyzed in ocean science research (F(1,37)= 4.794, p =.035). There was no relationship between AP completion and variables related to the extent in which workshop topics were added to instruction or with quality or changes in teaching. There was no significant relationship between the quality of the AP as measured by APQI and these items.

Table 21 Impact on CC Knowledge, Confidence, and Teaching Changes by Action Plan Completion (0=Strongly Disagree, 4=Strongly Agree)

		Action Plans	
		Not Completed (N=13)	Completed (N=28)
More Confident**	M	2.92	3.74
	SD	1.12	.45
Depth of Understanding	M	3.15	3.81
	SD	1.14	.40
How Teach Scientific Inquiry	M	2.62	3.07
	SD	.65	.78
How Scientific Instruments**	M	2.85	3.44
	SD	.69	.64
How Data are Collected/ Anal*	M	3.00	3.44
	SD	.60	.58
Extent added topic(s)	M	2.33	2.74
	SD	.98	.76
Changed way teach	M	2.69	2.93
	SD	.75	.73
Quality of my teaching	M	3.15	3.33
	SD	.69	.73

Significantly different at * $p<.05$, ** $p<.01$

Participant Characteristics, AP Completion, Quality of and Changes in Ocean Science Instruction

Whether the relationship between the completion of AP affects these items is different depending on participant characteristics was examined through stepwise regression analysis, with gender, race, and years teaching ocean science entered as independent variables and confidence, knowledge, and teaching changes variables entered as independent variables. In these cases, only gender and completion of AP were found to be significant predictors of these items (See Table 19). Identifying as female and completing the AP were significant predictors of the degree of agreement that as a result of the workshop, participants had a greater depth of understanding of ocean science and confidence in teaching ocean science, accounting for 30-35% of the variance on those items. Women were in stronger agreement that the workshops improved the quality of their ocean science teaching and added topics to their courses to a greater extent. Action Plans completion was also a significant predictor of degree of agreement that the workshops increased their understanding of how to teach about data collection analysis in ocean science.

Table 22 Regression Table of Gender and AP Completion as Predictors of Institute Impact Items

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Depth of Understanding			Confidence			How Teach Sci Data Collection/ Analysis			Extent added topic(s)			Quality of my teaching		
Variable	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β
Gen (0=F, 1=M)	-.070	.018	-.500**	-.059	.022	-.358**	-	-	-	-.571	.261	-.338*	-.478	.219	-.335*
Action Plan Complete	.053	.020	.357**	.080	.024	.453**	.444	.203	.339*	-	-	-	-	-	-
R^2	.346**			.299**			.091*			.388*			.089*		
F	11.06**			9.111**			4.794*			4.771*			4.790*		

*sig at p<.05 **sig at *p*<.01

Summary of Findings

Action Plans

- Participants completed Action Plans as a part of half of the eight institutes, beginning in 2011. In total, 271 Action Plans were generated, with the greatest proportion created in SPMC 2012 and then equally among the other three 2011-2012 institutes.
- Action Plans were of variable quality, with just over half of the participants creating high quality Action Plans that were both comprehensive and included details that would support inquiry-based instruction.
- Approximately half of the respondents who indicated they had completed an Action Plan reported that they found the AP somewhat or very helpful, and reported that they used them to some or a moderate extent. Respondents reported using the AP as a reference or guide for applying AP information in their courses. Others reported using the AP as a way to process the information and developing activities for their courses. None of the participants reported that they used them to a large extent.
- Completing the AP contributed to participants' perception that as a result of the workshops, they had a greater depth of understanding of ocean science, confidence in teaching ocean science, and understanding of how to teach about data collection analysis in ocean science.
- There was no relationship between AP completion or AP quality and variables related to the extent in which workshop topics were added to ocean science instruction or with quality or changes in ocean science teaching.

Increased Understanding of Ocean Science Topics

- Participants reported that the PP Institutes had a positive impact on their understanding of ocean science topics. Most participants agreed or strongly agreed that as a result of the workshops, they increased the depth of their understanding of ocean science topics, as well as how instruments are used and data collected in ocean science research. Participants also reported that their knowledge of ocean science was more current as a result of the workshops.
- Participant backgrounds—their formal science education, the amount of time it had been since they had formally studied ocean science, and their experience teaching ocean science—accounted for differences in how the workshops affected their ocean science knowledge.

Improvement in the quality of ocean science teaching

- Participants reported that the workshops had a positive impact on their teaching. Most all participants agreed or strongly agreed that they were more confident teaching ocean science and that as a result of participation, the quality of their teaching of ocean science topics improved. A smaller majority agreed or strongly agreed that participation in the workshops led to improved teaching of scientific inquiry.
- Approximately two-thirds of participants reported changes in their teaching as a result of workshop participation, including a change in their ocean science teaching, the addition of more about scientific inquiry, and the addition of information about scientific instruments used to study the ocean.

Ways in Which Ocean Science Teaching Changed

- Participants reported an increased enthusiasm for teaching, more support and opportunity for student inquiry, a change in focus to include more ocean science topics, more depth to their teaching, and the inclusion of more ocean science media, research, and other resources.
- Half of the participants added workshop topics to a moderate or large extent.
- There was high variation in the frequency in which topics were added to participant instruction. Some of the most commonly applied workshop topics included *Plastics in the ocean*, *Using Online Data*, and *Ocean Currents*. There is no apparent pattern to the types of topics that were applied, although the topics in the SPMC 2010 were reported to be less often applied.
- Twenty-two percent of participants reported creating new ocean science courses as a result of the workshops.

Constraints to Applying Workshop Topics or Changing Teaching

- Close to half of the respondents had topics they were interested in including in their teaching, but found that they could not include them. Reasons for not including topics had to do with the lack of time and resources: either a lack of equipment or the activity was too time intensive , they were already an inquiry-based teacher, topics and activities were too advanced for their CC students or courses, or they were teaching online courses and found the activities difficult to apply.

Participant Networks

- Approximately half of the participants reported communicating with other workshop participants about teaching ocean science to some or a moderate extent,

and a majority agreed or strongly agreed that the COSEE PP network Listserve was useful.
- The online network was seen as a way to address the isolation some CC instructors felt and as a resource for ideas about teaching ocean science.

Perception of Impact on Student Ocean Science Learning and Career Potential

- In general, respondents felt that their participation in the workshops had a positive impact on their students, although some felt that they did not have enough evidence to comment on the impact on students learning or careers.
- The majority of participants agreed or strongly agreed that participation in the workshops led to an increase in students' understanding of ocean science, scientific inquiry, scientific instruments are used in ocean science, and local marine topics.
- A majority of participants agreed or strongly agreed that students are more engaged in inquiry activities, including labs and working with "real' data.
- There was moderate agreement that as a result of their participation in workshops, their students were more engaged in field work, had a greater career potential, and participated in more internships.
- A majority of participants also agreed that students showed increased interest in ocean science.

Participant Characteristics and Impact on Ocean Teaching Quality of and Changes in Ocean Science Teaching

- The impact on the quality of and changes in ocean science instruction differed by gender.
- There were no significant differences by race, years teaching postsecondary or ocean science, participant degree areas, or the type of courses participants teach on any of these items.
- Women were in stronger agreement that as a result of the workshop, they had a greater depth of understanding of ocean science and confidence in teaching ocean science.
- Women were in stronger agreement that the workshops improved the quality of their ocean science teaching and added topics to their courses to a greater extent.

Conclusions

- **Participation in the COSEE PP Institutes with their workshop format resulted in quality improvements in ocean science teaching in community colleges**. Most all participants reported an improvement in the quality of their ocean science teaching.

- **Participants increased their confidence in teaching and knowledge of current ocean science research**. Participants reported an increase in their knowledge of ocean science, scientific instruments, and how data are collected and analyzed in ocean science research.

- **Participants changed their ocean science teaching as a result of the workshops, although reports were mixed**. Half of the participants reporting that they added workshop topics to a moderate or large extent to their teaching. Participants also reported developing new courses as a result of the institutes. Changes in teaching tended towards including topics and activities that were more ocean science research focused and in more depth, as well as supporting more student centered, inquiry-based learning.

- **The degree to which workshop topics were added was subject to Community College contextual constraints**. Participants cited a lack of resources, topics too advanced for students' ability level, and inappropriateness for type of courses taught as common reasons not to include workshop topics.

- **For the most part, impact of the workshops did not differ depending on participant characteristics.** The exception to this was that women were in higher agreement than men that the workshops increased their confidence, their knowledge of ocean topics, and how to teach ocean science topics..

- **Action Plans contributed to participants' ocean science teaching.** Action Plan completion supported participants' understanding of workshop ocean science research topics, and were used by participants as a reference when teaching. There was no evidence that Action Plans contributed to the extent in which topics were integrated into courses.

- **Participants perceived that the workshops had a positive impact on student learning and career potential, but more evidence needed**. Participants perceived students to show more interest, and have a greater understanding of ocean science topics. Much of the impact on career potential was attributed to the associated COSEE PP internship program rather than to the workshops directly. A number of faculty felt that they did not have enough evidence to comment on the direct impact on students' learning or careers.

RECOMMENDATIONS

1) *Continue with the current COSEE PP Marine Institute workshop model as a means of improving ocean science instruction in community colleges.*
2) *Reach out to junior and part-time faculty to include more of them in institute, or provide strategies for participants to share information.*
3) *Explicitly address community college constraints that may impede implementation by providing strategies for translating topics for integration into non-major, introductory, or non-marine science courses, addressing lack of resources, and applying to online courses.*
4) *Provide prompts within Action Plans and AP models that would support more high quality, inquiry-based applications of workshop topics and problem-solving that will address constraints to implementation.*
5) *Incorporate more explicitly ocean science career connections for community college students, including those whose are pursuing an Associate's Degree only as well as those who will moving on to 4-year degrees or beyond.*
6) *Incorporate alternative strategies for faculty to assess the impact of workshop activities on their student learning.*

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APPENDIX

TABLES OF PARTICIPANT DEMOGRAPHICS

Table 23 Institute Attendance and Survey Response

	Number Respondents Attending Their First Institute	Number Respondents Attending Additional Institute	Number Respondents (Both First and Additional Institute)	Total Number Participants Attending institute [a]	Response Rate per Institute
2009 OIMB	5	0	5	11	45%
2010 SPMC	3	0	3	10	30%
2010 HMSC	9	0	9	14	64%
2011 SPMC	5	8	13	14	93%
2011 OIMB	5	2	7	14	50%
2011HA	7	2	9	13	69%
2012 SPMC	4	6	10	15	67%
2012 HA	3	6	9	10	90%

[a] *Attendance as reported by Institutes*

Table 24 Response rate for PP Participants Interviewed by Institute

	Number Interviewees Attending Institute	Total Number Participants Attending institute [a]	Response Rate per Institute
2009 OIMB	2	11	18%
2010 SPMC	3	10	30%
2010 HMSC	4	14	28%
2011 SPMC	4	14	28%
2011 OIMB	7	14	50%
2011HA	2	13	40%
2012 SPMC	6	15	40%
2012 HA	3	10	30%

Table 25 Number of Participants by Race and Gender

	Gender			
Race/Ethnicity	Female	Male	Total	%
Nat Hawai'i	0	0	0	0
Hispanic	0	0	0	0
Nat American	0	0	0	0
Afr American	0	1	1	3
Asian	1	1	2	5
Pac Islander	3	3	6	16
White	18	11	29	76
Total (N=41)	22	16	38	100
%	58	42	100	

Table 26 Participant Degrees (N=37)

	Degree				
	Certificate (%)	BA/BS (%)	MA/MS (%)	EdD/PhD (%)	Total[a]
Education	2 (4.9)	1 (2.4)	8 (19.0)	2(4.9)	13
Earth Science	-	2 (4.9)	5(15.0)	2 (4.9)	9
Biology	-	16 (39)	19 (40)	3 (7)	38
Chemistry	-	1 (2.4)	1 (2.4)	-	2
Marine Science	-	1 (2.4)	4 (4.9)	2(4.9)	7
Engineering	-	-	1 (2.4)	-	1
Math	-	1 (2.4)	-	-	1
Total[a]	2	22	38	9	71
Other (N=10)					
Missing (N=4)					

Note: "Other" degrees included Botany, Geology, Family/Child Dev, Meteorology, Biochem, Economics & Resource Development, Plant & Soil Ecology, Wind Energy. Percentages (%) are out of total survey participants (N=41).

[a] Some participants have multiple advanced degrees.

WORKSHOP TOPICS ADDED TO TEACHING BY INSTITUTE

Table 27 Workshop Topics Added by Institute

2009 Marine Biology – Oregon Institute of Marine Biology (Total Participants in Institute N=11)	Number Participants Added Workshop Topic
Rocky shore biology	5
Estuarine biodiversity and invasive species	4
Oceanography – density and stratification	4
Dungeness crab biology	3
Estuarine environments	3
Ocean bacteria – Bioluminescence	3
Island ecosystems: marine birds, introduced species, sea mounts	2
Ocean bacteria – Winogradsky columns	1
2010 Oceanography – Hatfield Marine Science Center (Total Participants in Institute N=10)	
Plastics in the ocean	7
Ocean energy (wind, wave, tidal)	6
Ocean observing systems	4
Carbon cycling and global climate change	3
Phosphorus, nutrient loading, and eutrophication	2
Ocean acidification	1

Table 27 cont.

2010 Climate Change and Eutrophication in Coastal and Marine Ecosystems – Shannon Point Marine Center (Total Participants in Institute N=14)	
NANOOS and real time data	2
Ocean acidification	2
Hypoxia	1
2011 Marine Science – Oregon Institute of Marine Biology (Total Participants in Institute N=14)	
Using online datasets to explore the ocean	5
Abiotic factors in the intertidal zone	4
Bioacoustics and sound in the sea	4
Deep sea biology	4
Building and testing ROVs	3
Adaptive responses to physiological stressors by intertidal organisms	2
Ocean Acidification	1
Will do salinity testing in labs later this semester	1

Table 27 cont.

2011 Marine and Coastal Science of the Salish Sea – Shannon Point Marine Center (Total Participants in Institute N=14)	
Rocky intertidal (surveys and data analysis)	6
Using online data	5
Intertidal microalgae	5
Sound Citizen and Contamination in Puget Sound	5
Tides and phases of the moon activity	4
Fisheries, beach seining, and data analysis	3
Tidal Power	2
Whatcom Science Lab Series	1
2011 Microbes in the Sea – University of Hawai'i (Total Participants in Institute N=13)	
Abundance and diversity of marine microbes	6
Microbial ecology and symbiosis	6
Bioluminescence in the sea	6
Bacteria on coral reefs	5
Microbial Oceanography	4
Marine biofilms and larval recruitment	4
Marine bacteria in evolution and biological interactions	4
Sea turtle disease	3
Hawai'i Ocean Time-series (HOT)	2
Techniques for studying biofilm-bacterial communities.	2
STARS program and C-MORE Science kits	1
Great Ocean Conveyor	1

Table 27 cont.

2012 Oceanography – Shannon Point Marine Center(Total Participants in Institute N=13)	
Using online data to bring science to the classroom	7
Lab activities for demonstrating ocean currents.	7
Life at low Reynolds numbers	6
Microzooplankton, grazing and microbial food web dynamics	4
Larval ecology and plankton dynamics	3
Phytoplankton diversity in marine ecosystems	3
Intertidal survey - marine debris	3
Phytoplankton growth and abundance experiment	2
Invasive species and the ecological process of biological invasions	2
Molecular Ecology of Deep Sea Hydrothermal Vent Ecosystems	1

Table 27 cont.

2012 Population Linkages in the Pacific Ocean – University of Hawai'i(Total Participants in Institute N=10)		
Law, policy and implications in marine management.	6	14.6%
Market fish DNA extraction, sequencing, and reading and manipulating sequence data for connectivity analysis	5	12.2%
Tagging, Telemetry and Biologging methods for studying movements of marine animals	5	12.2%
PCR and the basics of sequence data	4	9.8%
Multi-species connectivity for ecosystem based management in the Hawai'ian Islands	3	7.3%
Genomics, bioinformatics, and their contribution to understanding connectivity	2	4.9%
Genetic methods to estimate gene flow in the marine environment	1	2.4%
Sequence data, population genetics, F-statistics and how it ties to connectivity theory	1	2.4%
Assumptions of different analyses and using appropriate analyses for different data types	1	2.4%

EXAMPLES OF HIGH QUALITY ACTION PLANS

Table 28 Example of High Quality Action Plans

Bioacoustics	"Record several sounds from campus and have students hypothesize where they were recorded; Give students data set of whale voc. and have them determine set of summary data for comparison among whale species (ecological significance, social system diff.)"
Reynolds Number Lab	" Students discuss relative difficulty of walking through air vs. water. What causes the difference? would walking through honey compare? How would pushing a flat board through the medium affect difficulty? Conduct an experiment: Use a toy boat with a rubber-band driven propeller to move through media with various viscosities. Measure time and distance the boat travels in each medium to determine speed. Measure length of front of boat. Use the Reynolds number formula to calculate the boat's Re in each medium. Use given lengths and speeds of various microorganisms to calculate their Re's in water. Which medium represents an approximation of what it is like for each microorganism swimming in water? Observe zooplankton and relate their movements to the difficulty they have with moving through water. Determine the mechanisms different organisms have for swimming and relate to the speed and movement style for each organism. Imagine you lived in honey. How would that affect your movements and abilities to obtain food, reproduce, etc. "
Tagging, Telemetry, and Biologging	"Use the Flow weaver to give a dynamic aspect to discussion of food webs in ecosystems. Make this a hands-on small group activity. We have computers for our lab. NANOOS data will be more appropriate if I get to teach Marine Bio"

ACTION PLAN TEMPLATE

ACTION PLAN FOR USE OF INFORMATION FROM THE COSEE COMMUNITY COLLEGE FACULTY SUMMER TEACHING INSTITUTE AT SHANNON POINT MARINE CENTER:

August 2012

Name: Short Course Topic/Presenter:

What information on this topic was most useful for my teaching?

Course(s) in which I may use this information:

Ideas for what I might do with this information (e.g. lab session, student activity in class, student/group project, etc.

Why would I teach this to my students? i.e. What are the learning goals for my students to which this information applies:

Additional resources I need:

About the Evaluator

Dr. Genevieve Manset, PhD, is the director and owner of Literacy Services, which provides intervention, consulting, and program evaluation services to students, schools and other nonprofits in the areas of disability, literacy, STEM education, and science outreach. As the former Director of Special Education at Indiana University, she prepared teacher candidates and doctoral students in the areas of RTI, assessment, instructional methods, special education, and applied research. She has experience in both quantitative (from multivariate to single-subject designs) and qualitative research, and has published widely on the topics of comprehensive school reform, assessment, and literacy as they relate to students with disabilities or at-risk for school failure. Dr. Manset has directed over $448,287 in research or evaluation grant projects, many which have involved project evaluation in high poverty-schools with minority students or those who have limited English proficiency. As an administrator in a large teacher training institution, Dr. Manset has also developed comprehensive program evaluations for teacher education programs.

Currently, she lives in Honolulu, and is serving as an adjunct lecturer in the Special Education Department at University of Hawai'i-Manoa, and is a consulting program evaluator for NSF funded STEM outreach and science education grants located in Hawai'i and on the mainland. More information can be found at genmanset.com.